TOOL ENGINEER

NOVEMBER 1956

machining plastics

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

AUTOMATION SIMPLIFIED

Two-Station Automated Multi-Unit Bore-Matic precision finishes 8 different surfaces at 140 parts per hour The versatility of Heald Borizing, and the ability to perform several different operations simultaneously at a single station can contribute to the simplicity and economy of an automated production line.

The Multi-Unit Bore-Matic shown here, for example, can do in just two work stations what might otherwise have required more machines and a more extensive workhandling system. In this simple setup, cast iron pump covers are bored, turned, faced, grooved and chamfered at 140 parts per hour at 75% efficiency. Two parts are Borized simultaneously at each station and all operations except initial loading and final unloading are fully automatic.

For Automation that pays its own way . . .

IT PAYS TO COME TO HEALD

Left-Hand Head:
Bore Two Diameters, Generals
STATION NO. 2

Right-Hand Head:
Bore smill Diameter
Left-Hand Head:
Bore smill Diameter
Left-

HEALD

THE MEALD MACHINE COMPANY

incinnati Milling Machine Co.

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COVER: Machining of plastics introduces problems and methods not standard in metal-working shops. A series of articles on plastics machining, first of which starts on page 111, will de-acribe the methods and techniques used on various types of engineering plastic materials.



He Appreciated .

The Tool Engineer

Volume XXXVII, No. 5

November 1956

. . By H. C. McMillen

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ENGINEER





The Tool Engineer

Fitting Automation to Production

Now management understands the meaning of feedback. That was a statement of an executive at International Harvester during its recent conferences on automation. However, feedback, as a word, is mysterious and forbidding to many, even some who are familiar with its application and use. This probably results from its introduction into our vocabulary through electronics. Feedback is merely an element of the third of the three stages of automatic measurement-indicating, recording and controlling. Controlling requires feedback, which is the signal resulting from a previous measurement, to adjust a machine or process.

The conferences at International Harvester consisted of a series of two-day meetings with formal papers, seminars and actual demonstrations on some of the latest machines and equipment for modern production. Included in the demonstrations were tape-controlled machining, tracercontrolled lathes, work transferring, cutting with ceramic tools, milling with throw-away carbides, ultrasonic machining, automatic loading and unloading, automatic gaging, and automatic sorting. Also, there were demonstrations of the latest developments in control systems and components-digital and analog computers, binary system converters, memory units, etc.

Planned by the manufacturing research staff, these meetings informed management as well as key production personnel of the potentialities of mechanization through the use of modern methods. At these meetings it was possible to study specific phases of production to see how problems have been solved and how equipment may be designed to improve manufacturing methods.

An understanding management is essential to implementing a modernization program and to attaining its maximum benefits. Such programs are costly and require scheduling both for installing equipment and training personnel. Also, key production men benefit directly from the conference. It is they who must see the possibilities of automation and interpret them into reality for their own production methods. The conference not only stirs their imagination but also poses a challenge to their ingenuity.

hu W Greve



CHECK MASTER contact point on work piece shown 20 times actual size. To see the smallest variations CHECK MASTER will detect, illustration would need to be 500 times actual size.



CHECK MASTER in use checking face location on surface plate.

The importance of measuring practically nothing

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Is so unusually sensitive that it responds to dimensional variations as fine as .000020"!

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COMPARATIVE	ANALYS	S OF	TEST	INDIC	ATORS	
4111	NDARD MASTER	Make A	Make B	Make C	Make D	Make E
Bearings Jeweled	ALL	Some	None	None	None	Some
Bearings Removable	ALL	Some	Some	None	ALL	ALL
Pivot Ends Covered	YES	YES	No	No	No	YES
Ratchet Contact Point	YES	YES	YES	No	YES	No
Contact Pressure (gr.)	15-15	23-33	23-33	23-23	45-49	28-38
Contact Pressure Equal in Both Directions	YES	No	No	YES	No	No
On-Center Mounting Vertical & Horizontal	YES	No	Vert. Only	No	Vert. Only	No
Absence of Reversing Lever	YES	No	No	YES	No	No
Total Weight (grams)	29	42	33	70	77	35
Hand Rotation Always Clockwise	YES	No	No	YES	No	No
.001" & .0001" Convertible	YES	No	No	No	No	No

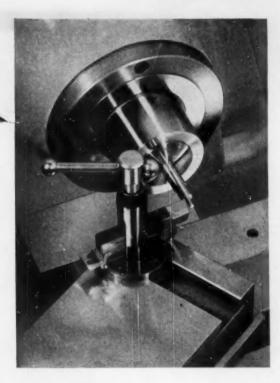
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THREAD BOLLING

Field installations of the new LANHYROL Thread Rolling Machine are producing outstanding results. Production data from representative jobs, shown on the opposite page, indicate the unequalled output, flexibility, and range coverage of this revolutionary new machine, not available anywhere else in the Western Hemisphere.

The LANHYROL Thread Rolling Machine produces strong, accurate threads of excellent finish by the chipless, cold-forming process using four different Rolling Methods—Thrufeed, Infeed, Continuous, and Reciprocal. It will thread all diameters from $\frac{3}{16}$ " to $\frac{3}{16}$ ", producing left- and right-hand threads of all types (except square), including UNC, UNF, Acme, worm, and many special forms.

Additional information on request—please send specifications and ask for Bulletin E-60.

WORKPIECE: Jack Screw
MATERIAL: C1018 Steel
THREAD SPECIFICATIONS: 1"-5 pitch
27° Acme
TOLERANCE: Class 3C
METHOD: Thruft and Rolling
PRODUCTION: 30" per minute (rolled in 36" lengths—can be rolled in 12 langths).





WORKPIECE: Bouble-End Stud MATERIAL: C1040 and SAE 8620 Steel THREAD SPECIFICATIONS: 2"-41/2 pitch NC—3" thread length TOLERANCE: Class 3 METHOD: Infeed Rolling (manual loading) PRODUCTION: 11/2 min, rolling time



WORKPIECE: Serrel—MG Gun Personator

MATERIAL: 60 Cerb, Silicon Tool Stl.

THREAD SPECIFICATIONS: 17/1" 6 pitch Stub-Acmo—I" thread length

TOLERANCE: Class 3G

METHOD: Infect Rolling (hand-operated worksholding fixture)

PRODUCTION: 15 pieces per minute



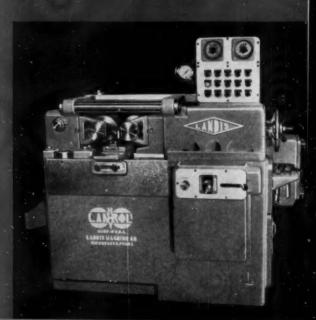
WORKPIECE: Aircreft Bolf
MATERIAL: 4340 Steel of 36-40 Rockwell C
THREAD SPECIFICATIONS: 1"-14
pitch NF-1-5/16" thread length
TOLERANCE: Class 3A (Military Spec.
MIL-B-7838-A)
METHOD: Intreed Rolling (manual loading)
PSODUCTION: 10 places per minute



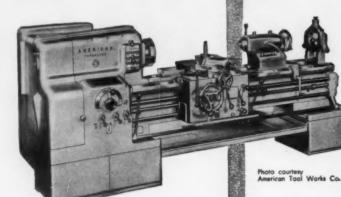
WORKPIECE: Transfer Drive Worm
MATERIAL: Stainless Steel
THREAD SPECIFICATIONS: 1/4"-26 diametral
pitch, left-hand, single—1/4" thread length
TOLERANCE: .1825—1805 P.D.
METHOD: Inteed Rolling (menuel loading)
PRODUCTION: 20 pieces per minute



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the finest high production lathes

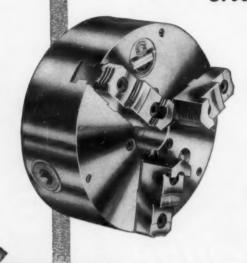


Here is the new 16" DeLuxe Model "AMERICAN" Pacemaker Lathe. This new design places particular emphasis upon the factors of power, stamina, dependability, precision, accuracy and ease of operation required for both production and tool room service. For complete data write for Bulletin No. 116, The American Tool Works Co., Cincinnati 2, Ohio.

deserve the finest high production chucks

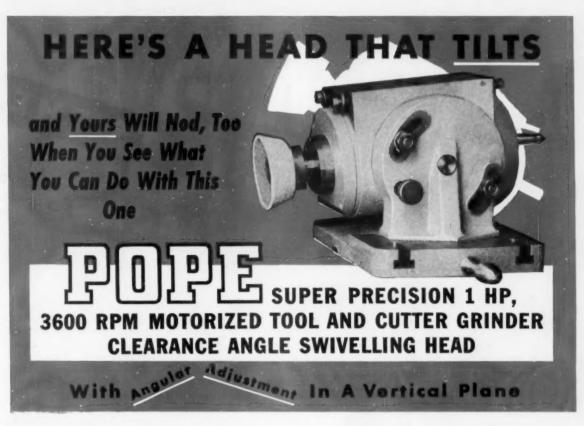
This is Horton's 3-Jaw Scroll Universal Chuck which for more than 100 years has been the companion to the world's finest lathes. Its lasting accuracy and precision contribute to the high production of any tool room or plant. For the complete story on this and Horton's complete line of high production chucks, see the Horton people in your area now.





HORTON CHUCK DIVISION

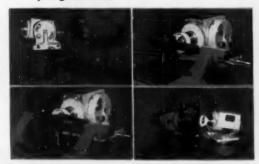
GREENFIELD TAP AND DIE CORPORATION WINDSOR LOCKS, CONN.



Give this versatile head the nod and save time and money these seven ways:

- You can use cup wheels for practically all clearance angles and thus produce a cutting edge on tools that lasts longer because it is stronger.
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- You can grind most cutters and reamers all over with a single set-up using the swivelling table and Pope tilting head.
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The operations performed include precision boring, facing and undercutting of the stainless steel support flanges. Close tolerances must be and are held.

Credit is due the "Ryan" engineers for developing such workable and time saving fixtures. Credit is also due the "Ryan" officials for selecting "AMERICAN" Hole Wizard Radials as part of the "winning combination."

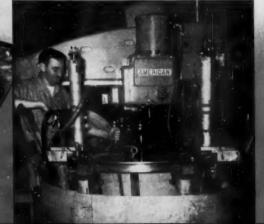
"AMERICAN" Hole Wizards are sturdy; they are powerful; they are easy to operate and they retain their original accuracy for years to come. For substantiation just ask the operator.

Bulletin No. 315 will give you the facts

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THE AMERICAN TOOL WORKS CO.

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Turret lathes—Tool life doubled, machining 4620 steel forgings; rancidity and rust eliminated.

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Turret lathes—Coolant life extended to six weeks, with no rancidity or rust; now using as general-purpose cutting oil.

Turret lathes—Doubled number of parts per tool grind.

Surface grinders—Superior finish; good wheel life; no rusting or obnoxious odors.

Turret lathes—Saves money because per-

Turret lathes—Saves money because performance is equal to, or better than, that of oils costing half again as much.

Tapping—Increased pieces per grind from 250 to 1800, tapping tough steel forgings.

Threading—Producing 60 more forgings per set of chasers; no rancidity.



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DASCO D-20*

Exclusive new formula brings you better performance...cutting or grinding!

Stuart's Dasco D-20 drastically reduces the number of different cutting fluids needed in your plant—maintains or upgrades performance of your machines and cutting tools! For wide application on many different operations not requiring highly developed water-mix grinding and cutting fluids like Stuart's Codol or Stuart's Solvol, this new low-cost water-mixture has an E.P. base oil additive that provides high antiweld and lubricity characteristics, plus superior wetting ability.

IMPROVES PERFORMANCE OF YOUR MACHINES AND CUTTING TOOLS—You get longer tool life because Stuart's Dasco D-20 reduces friction and heat, effectively stops welding. Superior wetting ability takes heat away fast. Finish and accuracy are improved because there's no build-up on cutting edges. Fine chips settle

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These and other cost-cutting benefits are the result of careful, experienced formulation by Stuart... the company that pioneered heavyduty soluble oils more than 15 years ago.

*SAME AS NPD-D-20



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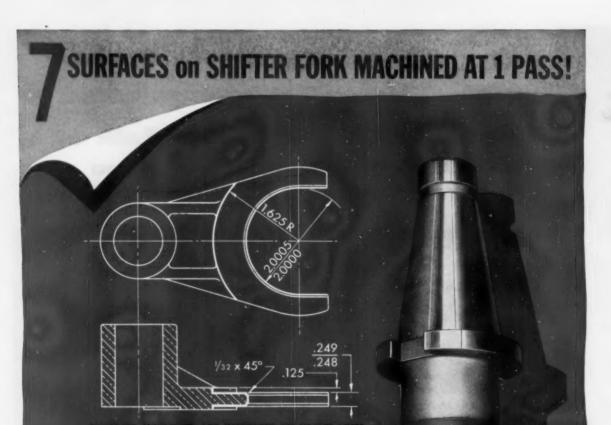
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Illustration shows setup for completely machining shifter forks on standard Vertical Milling Machine to precise limits of accuracy on a production basis. This application of Microbore Cluster Tooling permits use of simple low-cost work holding fixture, and substantially reduces tool costs per piece.

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Production Pointers from



TIME-SAVING IDEAS



GISHOLT

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

HOW HARLEY-DAVIDSON SPEEDS MOTORCYCLE PART PRODUCTION

Machines Both Ends in Single Chucking, Using No. 12 Automatic with Auxiliary Slide, Special Locator and Tool Relief

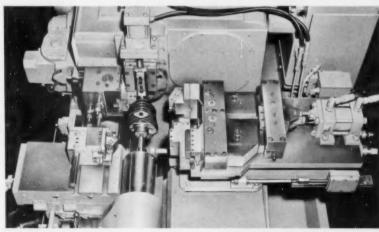
You may spot production ideas here from the way Harley-Davidson Motor Co. of Milwaukee, Wis., is handling cast iron rear and front cylinders.

A Gisholt MASTERLINE No. 12 Automatic Production Lathe is doing the job, machining 6 different sizes and types of workpieces. Smart tooling permits machining the maximum number of surfaces in the minimum amount of time. Change-over is especially fast and easy.

Here's a typical operating cycle: The workpiece is chucked in the rough machined bore on an expanding mandrel. A special headstockmounted, air-operated locating stop speeds work handling. While tools in the front carriage move longitudinally to turn and chamfer both ends on one side of the piece, tools in a headstock-mounted auxiliary slideoperated through a rack and pinion actuated by front slide movementmove in to chamfer the I.D. on the other side. At the same time, tools on the rear slide move in to face both ends for length. At the end of the cut, tool blocks mounted on the rear independent slide automatically swing open to provide tool relief before withdrawal.

Floor-to-floor time on the part shown is 1.2 minutes. The other 5 workpiece sizes are easily handled by merely changing sleeves on the expanding mandrel and adjusting tools for the smaller sizes, and changing the mandrel itself for larger bore parts. Floor-to-floor times range from 1.8 to 3.6 minutes.

Standard No. 12 Automatic has flexibility to handle variety of parts with minimum change-over. Machining both ends in single chucking gives maximum accuracy, cuts production costs.



Workpiece and tooling, showing headstock-mounted locator, auxiliary slide, and special air cylinder which provides automatic tool relief for rear independent slide tools.

Three different types of workpieces handled, extra expanding mandrel and sleeves.





HOLDS DOWN COSTS ON TRICKY OPERATION

TIME-SAVING IDFAS

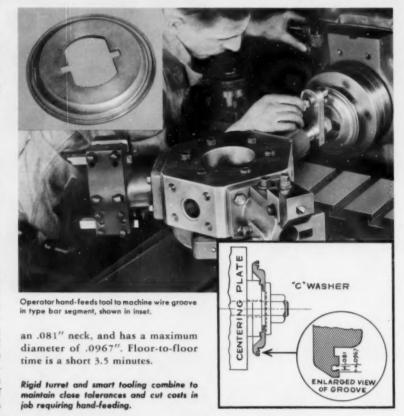
Accuracy and Adaptability of No. 4 Ram Speeds Machining of Type Bar Segments

There may be a production tip for you in this well-planned setup.

The workpieces are cast iron type bar segments, used in the printing industry. To keep costs at a minimum in an operation involving a close tolerance wire groove-requiring handfeeding-the manufacturer is using a specially-tooled No. 4 Universal Ram Type Turret Lathe.

The part has been previously machined on one side. Location is on a

centering plate, with the part held by a "C" washer and hand-stud. Rough and finish facing are performed by tools in the square turret. Forming and grooving operations are handled by tools on the hexagon turret. The close tolerance wire groove is finished, using a hand-fed tool with an indicator to assure correct depth of cut. The circular groove is cut through



AiResearch BALANCES WITHIN "KISS OF A WHETSTONE"



Gisholt 15 DYNETRIC Balancer Puts Ultra-Precision **Operation on Production Basis**

Main product of the shops at AiResearch Industrial Division of the Garrett Corporation, Los Angeles, California, is turbochargers for diesel engines - dynamic, power-boosting accessories operating 40,000 r.p.m. or more

With machining tolerances held in the "tenths," the job of balancing these assemblies is so close and critical that it must be "within the weight of metal removed by a whetstone stroke"! Here's how AiResearch is doing it-using a Gisholt 1S DYNETRIC Balancer.

For maximum accuracy, the components are balanced individually and as an assembly. Parts are rotated

Checking turbocharger rotating assembly for unbalance. Extremely small amounts of unbalance are measured and located through machine's infinitely variable amplification.

at 1500 r.p.m., with the standard stroboscopic lamp indicating exact angle of unbalance-and the amount meter telling the exact amount in terms of correction method employed.

Required accuracy is easily met by the standard Gisholt 1S, balancing the shafts to within 0.02 gram-inches, the compressor wheel to within 0.07. and the hot wheel to within 1.8 graminches. The same machine statically balances the exuder of the turbocharger to within 1 gram-inch.

Variety of parts and assemblies is handled on high-production basis with Gisholt 15 Balancer, without loss of accuracy and with minimum setup and change-over.

Write for free copy of Bulletin 1109-B, giving basic information on theory of balancing and on the complete line of Gisholt Balancing Equipment.



THE GISHOLT MASTERLINE

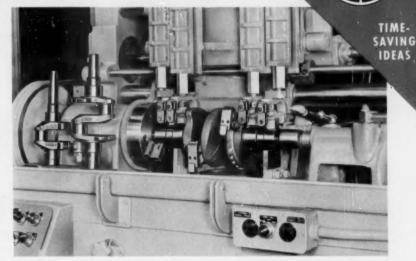
WHAT ONAN IS DOING WITH SUPERFINISH

Handles Crankshaft Mains, Pin Bearings and Oil Seals Simultaneously— Gets Finer Finish at Lower Cost

This pointer reveals how D. W. Onan and Sons, Inc., Minneapolis, has put crankshaft finishing on a high-production basis—using a Gisholt Model 51A Superfinisher.

The machine is tooled to handle up to 6 different diameters in one operation, on a variety of single- and 2-throw crankshafts. Loading and unloading of larger crankshafts are made fast and simple, with loading rails and special spindle-inching arrangement to position the driver.

Here's a typical operating cycle: Crankshaft is placed between centers, driving from keyway with faceplate driver. Two special latch-on, follower-type arms are engaged with the crank pins and 4 longitudinally adjustable quills descend to Superfinish main bearing and oil seal surfaces. The main and pin bearings are



Model 51A Superfinisher, showing crankshaft in place and 2 other sizes at left. Special upperoscillating Superfinishing heads are used. Although machine has automatic cycle, note control buttons permitting manual operation if desired.

taken from a ground surface of 30 micro-inches down to 8 or less. The oil seal surfaces on the shaft ends are Superfinished down to 4 micro-inches RMS, or less.

Here, Superfinishing handles 44 to 53 pieces per hour with 80% efficiency—with 1-hour change-over from one crank size to another. Each set of stones Superfinishes over 200 crankshafts on this job.

ONE WAY TO TRIM COSTS IN SHEAVE PRODUCTION

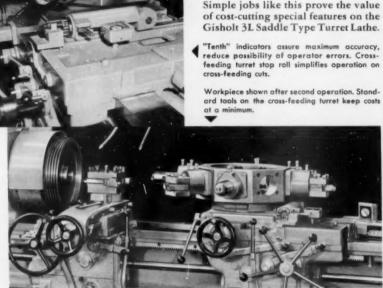
3L with Octagon Turret Provides Ample Capacity to Handle This Job and Variety of Other Work

Simple jobs like this prove the value

Workpieces are 20" diameter cast iron sheaves, machined in 2 fast operations. Tooling costs are held to a minimum through use of the crossfeeding octagon turret, which lets standard tools perform facing, forming, boring and chamfering operations. Tools on the square turret turn the O.D. and face the rim of the part. form the grooves on the O.D. and also chamfer.

Special features on the 3L improve accuracy and reduce setup time. The 8-position cross-slide stop roll is used to automatically trip cross-feeding movements of the turret. "Tenth" indicators simplify and speed up cross and longitudinal positioning, and make it easier to work to the accuracy required on these parts.

3L has versatility to machine sheaves to high degree of accuracy in minimum time, plus necessary capacity to handle all types of intricate jobs. "Tenth" indicators and turret stop rolls simplify work.







TIME-SAVING IDEAS

HOW EDWARD VALVES DIV. MACHINES, THREADS WITH FASTERMATIC

Threading Operation, Reverse of Spindle Included Within Automatic Cycle

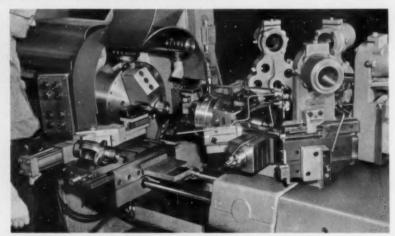
You'll like the way Edward Valves Division of Rockwell Mfg. Co., East Chicago, Indiana is machining 1½" steel Univalve bonnets with this setup.

The machine used is a new Gisholt 2F MASTERLINE Fastermatic Automatic Turret Lathe.

The job is completed in 2 chuckings, working with an 18" 2-jaw hydraulically operated chuck. In each operation the octagon turret carries necessary tools to handle all external and internal work, with facing completed from front and rear cross slides.

The first operation is on the bonnet end of the part. Threading the O.D. is part of the automatic cycle, using a collapsible die head. A 2-speed motor provides correct spindle speed.

In the second operation the I.D. is threaded on the other end, with the spindle automatically reversing to withdraw the tap. Operator's job is



MASTERLINE Fastermatic with octagon turret, tooled to perform first machining operations on $1\frac{1}{2}$ " steel Univalve bonnet forgings.

made easy through features like electric toggle switch control panel to simplify setup—permanent gauge on octagon feed cam drum for quick positioning during changeover—automatic positioning of spindle at end of cycle to simplify loading and unloading operations.

Floor-to-floor time for the first op-

eration is 8.5 minutes (including drilling, counter-boring and threading) and 2.8 minutes for the second operation to finish the valve seat.

Octagon turret provides tool capacity to complete job in 2 chuckings. Automatic cycle eliminates human error, lets operator handle additional units or do other work.

SIMPLIFIES LOADING OF COMPRESSOR DISCS

Air-Operated Pusher on Simplimatic Assures
Positive Location

Here's how the addition of a simple device has reduced operator fatigue and improved over-all efficiency. The device is an air-operated pusher, used on the Gisholt Simplimatic Automatic Lathe to speed work loading.

Workpieces are 24" diameter, aluminum compressor disc forgings for jet engines. Ordinarily, the large diameter and thin web section of this type of part make accurate locating and chucking especially difficult. With this setup, the operator simply moves the part into position and actuates

Air cylinder in foreground pushes workpiece against locating stops to simplify chucking part before machining operation starts. Table feed saves special tooling costs by engaging tools with work before standard slide movements beain.

the air-operated pusher, which holds the work firmly against locating stops while it is being chucked. Wide jaws are used to eliminate distortion.

All tooling is carried on standard slides, mounted at correct angle on wide platen table which—after chucking—feeds forward to engage tools with work. The rear slide is mounted at an angle to let tools perform an angular facing operation, while tools on the front slide machine 4 other faces and rough-turn the flange diameter. F.t.f. time is just 5.5 minutes.

Special device on Simplimatic makes loading faster, easier. Wide platen table promotes easy mounting of tool slides to correct angle for maximum efficiency.

11-1256



THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT

Madison 10, Wisconsin

TURRET LATHES . AUTOMATIC LATHES . SUPERFINISHERS . BALANCERS . SPECIAL MACHINES

MOTCH & MERRYWEATHER CUT-OFF BLADES and SLITTING-SLOTTING SAWS

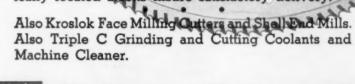
From
a very small
slitting saw to a
large cut off bl
Motch & Merrywe

STOCKING DEALERS in all principal cities.

FACTORY-APPROVED SERVICE in many industrial centers.

ENGINEERING SERVICE to solve your specific problem.

Challenge Motch & Merryweather to demonstrate that the Triple-Chip Method will cut off stock in faster time, with greater precision, and at lower cost than any other method. Rely upon Motch & Merryweather to engineer your job, recommend the right blade, and follow through. Our wide range of blades and saws is coupled with a wealth of technical experience and data on every phase of the circular sawing of all metals. Motch & Merryweather sales engineers in conjunction with dealers nation-wide stand ready to analyze your exact requirements and recommend a complete, profitable solution. Ample, strategically located stocks insure satisfactory delivery.



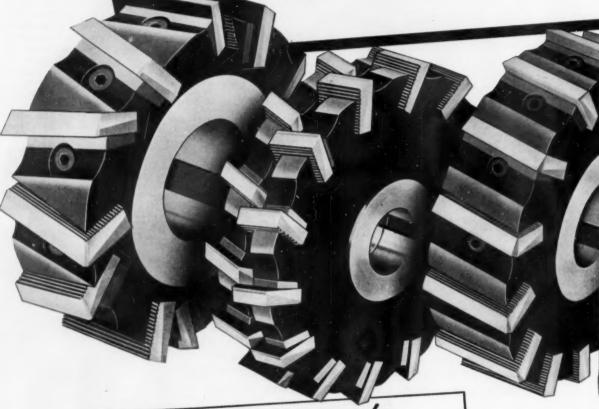


THE MOTCH & MERRYWEATHER MACHINERY CO.

Cutting Tool Manufacturing Division—
 1250 EAST 222nd STREET, CLEVELAND 17, OHIO

TRIPLE-CHIP CIRCULAR SEGMENTAL AND SOLID CUT-OFF BLADES • TRIPLE-CHIP SLITTING SAWS • KROSLOK FACE MILLING CUTTERS AND END MILLS • TRIPLE C GRINDING COOLANT • TRIPLE C MACHINE CLEANER • TRIPLE C CUTTING COOLANT

... and AGAIN MORSE MOVES AHEAD...



Another reason why means "THE MOST"

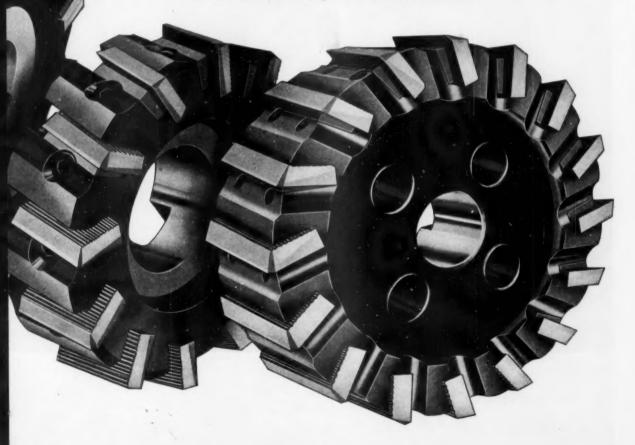
in Cutting Tools

with a Complete Line of Inserted Blade CUTTERS

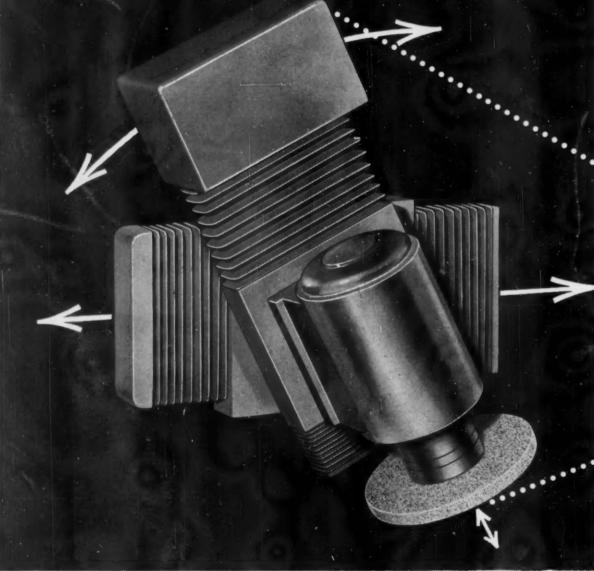
This new Morse line is complete . . . every standard type and size, plus any special up to 36"! And this new line makes the Morse-Franchised Distributor more than ever "the man with the most" in cutting tools.

MORSE TWIST DRILL & MACHINE COMPANY · NEW BEDFORD, MASS.

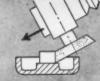
Subsidiary of VAN NORMAN INDUSTRIES, INC.
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

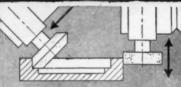


PRECISION GRINDING



Diagrams show typical applications of Frauenthal Standard Slide Units to a variety of grinding problems.





at any angle!

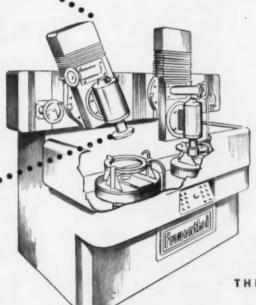
Frauenthal's creative engineering Now makes available Standard Slide Units in any number of combinations for production grinding applications ...

 \mathbf{I}^{T} is no longer necessary to absorb special engineering and design costs when Frauenthal Standard Slide Units - plus a variety of grinding spindles - can be assembled to machine bases appropriate to a particular job. And these standard slides in single or multiple units can be arranged in an infinite number of spindle positions to accommodate an endless variety of simultaneous or sequenced, automatically controlled grinding operations.

What's more, you get all the advantages of

Frauenthal's advanced engineering and design experience-proven on single and multiple-head grinders used on special production jobs. For example: parts for jet engines, diesel and automobile engines, tanks, gun mounts, radar units, large and small diameter precision bearings and machine tool components.

As illustrated here, this model of the versatile grinding compound shows how the Frauenthal Standard Slide Unit can be adapted to approach the work from any desired angle.



Here's a typical Frauenthal Double Head Here's a typical Frauenthal Double Head Vertical Spindle application utilizing two of the Frauenthal Standard Slide Units shown on the opposite page. Although ap-plied to a particular grinding situation, these slide units retain versatility for angu-lar positioning. Frequently, as indicated in panels 2 and 4 at the bottom of the page, diametrs and discont surfaces are ground. diameters and adjacent surfaces are ground at one time with a single wheel dressed to the proper contour.

> Send a print of your "problem grinding part" and our engineers will show you how to apply Frauenthal Standard Slide Units to solve the problem. Include in your letter pertinent production information - number of pieces, etc. Be sure to investigate the latest Frauenthal Vertical Grinders with Standard Slide Units. For complete details, contact Frauenthal of Muskegon.

THE KAYDON ENGINEERING CORP. MUSKEGON, MICHIGAN, U. S. A.



Announcing the NEW Cross Chucking Transfer-matic

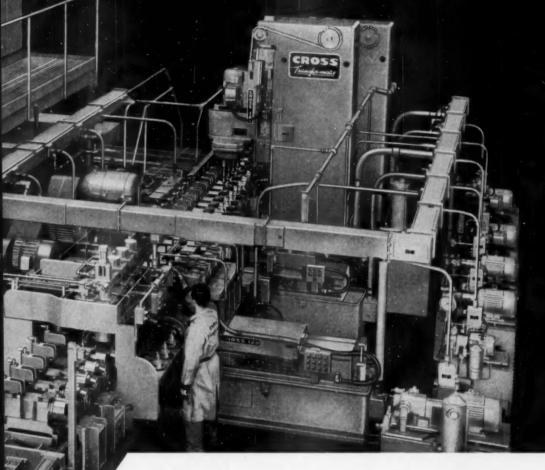
Fel. No. 2,745,167



Station 1

Station

Another Automation First by Cross



A completely new development! That's the Cross Chucking Transfer-matic ... the first chucker ever built on this principle. Standard Cross "building block" construction makes provision for any reasonable number of stations and work pieces up to 48" in diameter. This particular seven station Transfer-Matic, created for differential gear cases, has a rated capacity of 368 pieces per hour at 100% efficiency.

An unusual feature is that the work pieces are chucked and not released until all operations are complete. The chucks are mounted on precision spindles, which in turn are carried on pallets—four to the pallet. There are ten pallets—one at each station and three on the conveyor moving from Station 7 to Station 1.

Operations are: Station 1, four pieces positioned in work holding chucks by loading mechanism and clamped automatically. Station 2, pilot diameters turned and side gear pockets bored. Station 3, spherical seats generated. Station 4, flange faces and thrust faces for side gears generated. Station 5, pin hole for pinion shaft drilled after spindles are indexed into pre-determined position and locked to prevent rotation. Station 6, pin hole chamfered top and bottom. Station 7, pin hole rough and finish reamed with shuttle head.

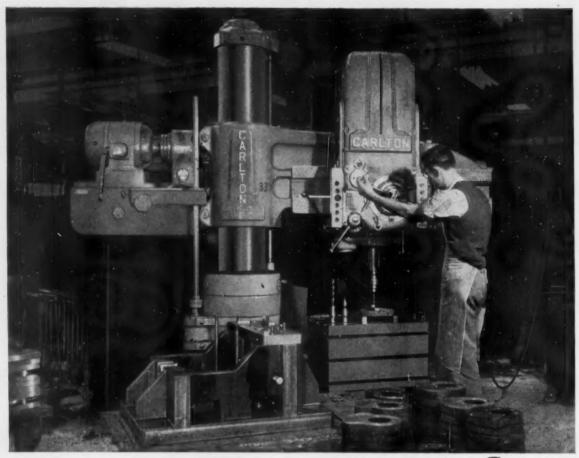
Features include construction to JIC Standards, hardened and ground ways, interchangeability of all parts, pre-set tooling and programmed tool changes with the Cross Machine Control Unit.

Established 1898

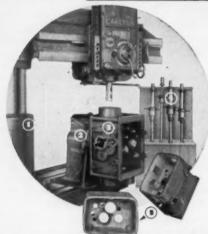
CROSS

First in Automation

DETROIT 7, MICHIGAN



Carlton production drilling for production line assembly



Carlton radial drills, properly tooled, give you production hole drilling with the precision performance so necessary for production line assembly. Parts come out of the drill jig with the uniformity that permits interchangeability of parts, eliminates unnecessary operations, makes substantial savings.

Carlton engineers will be glad to work with your engineers in recommending the best Carlton and the most efficient tooling for your requirements. Carlton radial drills are made in 5 models with arm lengths from 3-ft to 12-ft and column diameters from 9" to 26". Carlton horizontal drills made in 4H and 5H sizes. For complete information, call your machine tool distributor, see the Carlton brochure in Sweets Machine Tool Catalog, or write The Carlton Machine Tool Co., Cincinnati 25, Ohio, U.S.A.

Running time reduced from 7 hours on previous method to 5.25 on this Carlton engineered set-up: (1) Carlton 3-A radial drill

- (2) master trunnion (3) revolving jig
- (4) boring bars
- (5) transmission body casting 25% savings effected by eliminat-ing horizontal operation.



HORIZONTAL AND RADIAL DRILLS



Now! solenoid-controlled air valves
that defy improper maintenance
...they won't operate with their covers off!

When a solenoid valve operates without its cover, trouble is not far off. Dirt, oil, cutting fluid, chips are sure sooner or later to jam the solenoid, and the valve will fail to shift.

That can't happen with these new Hannifin valves!

The solenoids are held in place by their covers and won't operate the valves unless the dust-tight, splashproof covers are firmly tightened.

These new valves, which conform to the latest J.I.C. recommendations, are part of the complete "P-M" Pilot-Master line. New heads with these new solenoid covers are offered on 2-way, 3-way and 4-way Pilot-Master Valves (air-operated). The smaller, direct-operated 3-way and 4-way valves in the "P-M" line have been redesigned to use the same new covers. This added feature is just another reason why it pays to standardize on Hannifin air control valves.

AIR CONTROL

HANNIFIN

VALVES

Complete information on all Hannifin Air Control Valves is in this catalog. It belongs in your files. Write for your copy. Hannifin Corporation, 519 S. Wolf Road, Des Plaines, Illinois.



ROCKWELL-BUILT

TWO NEW DELT



ALL NEW DELTA 15"

World's most versatile drill press for all-ground shop use-extra rugged for production work!

WORLD'S MOST COMPLETE LINE—Choose from the world's widest range of models for every production and shop need; floor, bench. multiple-spindle set-ups-production or standard table-plus a complete line of components for adapting to special-purpose operations.

AMAZING VERSATILITY—Only Delta gives you a selection of six spindle adaptors for dozens of operations. And they're mounted on a ground taper for complete accuracy, feature a threaded collar for positive locking.

EXCLUSIVE "UNIVERSAL" HAND FEED-Only Delta combines the best features of pilot wheel and single lever feeds with an exclusive universal hand feed. Gives you adjustable leverage—freedom from striking table or fixtures-almost infinite choice of feed lever positions.

BUILT FOR PRODUCTION WORK-Spindle has four over-sized, pre-loaded, lubricatedfor-life ball bearings for extra ruggedness. Big 2" dia. quill and massive one-piece head casting provide greater rigidity. Multiplespline "floating drive" minimizes vibration, assures smoother operation.





DRILL PRESSES!

GREAT NEW DELTA 20"

Designed for production tooling—
a big-capacity, heavy-duty drill press
that's built to last!

BIG CAPACITY — You get 'full 6" spindle travel with 5½' high column for additional spindle-to-table capacity. Choose from a complete line: floor, bench, multiple-spindle models—production or standard table—No. 2 or No. 3 Morse Taper Spindle.

RUGGED, ACCURATE —Double row, preloaded heavy-duty ball bearing close to the work load eliminates spindle play, assures years of lasting accuracy. Big 3¾" dia. centrifugally cast iron column with ½" thick wall is precision ground to size to give rigid backbone to machine, and extra weight for smooth, efficient operation.

SAFE, SIMPLE OPERATION —Molded, reinforced fibre glass belt guard completely encloses belt and pulleys, swings out of way for fast speed changing. Guard will not dent like steel, crack like iron, rattle like iron or steel. Quick-set depth gage with magnified scale is easy to see, easy to read.

See the great new Delta 15" and 20" Drill presses—compare with any others, then make up your own mind! Your Delta Dealer is listed under "TOOLS" in the Yellow Pages of your phone book.

Send coupon for all the facts!

Delta Power Tool Division,
Rockwell Manufacturing Co.
620L N. Lexington Ave., Pittsburgh 8, Pa.

Please send me complete information on new Delta 15" and 20"
Drill Presses.

Please send name of my nearest Delta Dealer.

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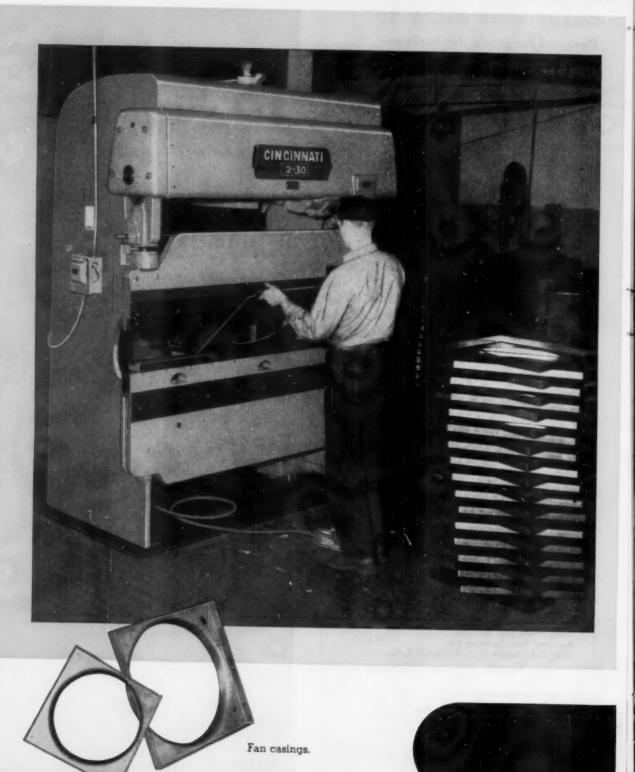
City

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This accurate Cincinnati



Press Brake saves money and time...



Photos courtesy of Anchor Metal Spinning Company.



Write for Bulletin "2 New Cincinnati Press Brakes" for complete information on these versatile machines.

at ANCHOR METAL SPINNING CO. Dayton, Ohio

Profitable production has been achieved by installing this Cincinnati Press Brake.

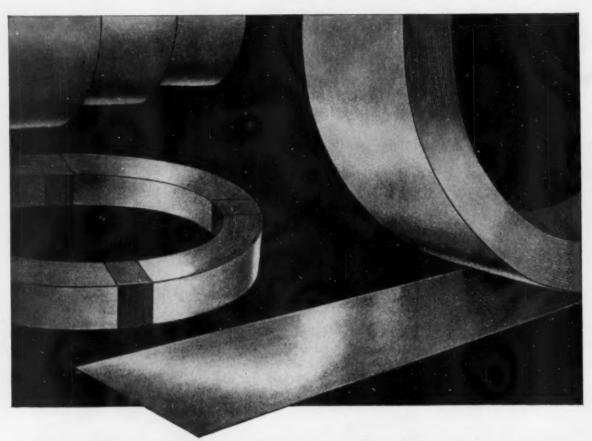
Accurate flanging of fan housings is done rapidly while meeting the rigid requirements for squareness. Operations on different sizes and gauges of materials are performed with ease. Parts for assembly are ready on time and smooth shop operation maintained.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A.

SHAPERS . SHEARS . BRAKES





Superior Quality, Retained in YOUR Product ... UDDEHOLM Strip Steel

Quality of materials is something that will always show up in the final product. So why not take advantage of the extra quality available in Uddeholm Swedish Strip Steel. For, besides transferring its inherent quality to your product, such a steel can seriously lessen production problems and rejects.

Reasons for Uddeholm Strip Steel "quality" are easy to explain. As a raw material Uddeholm uses famous Varmland iron ore, world-renowned for its exceptional purity. Added to this is a traditional craftsmanship in steelmaking almost three centuries old—where only the finest steel is accepted. Final perfection is guaranteed by a selective system of rigid inspection.

In terms of your application, then, this means cold-rolled strip steel of consistent uniformity, undeviating flatness, and fine finish—with straightness of edges and accurate dimensional tolerances throughout. And these features are combined in the grade, finish and dimensions you need, whatever your requirements. Widths range from ½" to 16½", thicknesses from .001" to .125". Tolerances as close as ±.00008" are possible. Slitting and edging facilities are also available.

Uddeholm Strip Steels appear in countless applications, including Stainless Steel products, stampings, intricate machine parts, all types of blades and springs, and many others. For quick delivery just phone us your needs.

Write for latest Strip Steel Stock List



UDDEHOLM COMPANY OF AMERICA, INC.

Tool and Die Steels Specialty Strip Steels

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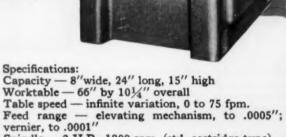
New York: 155 East 44th Street, MUrray Hill 7-4575 Cleveland: 4540 East 71st Street, Dlamond 1-1110 Los Angeles: 5037 Telegraph Road, ANgelus 2-5121

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CHICAGO: Frank J. Mackin, Leroy E. Marshall, 55 East Washington, STate 2-1649 DETROIT: Warren H. Nugent, 17304 Lahser Road, KEnwood 5-6340 PHILADELPHIA: Frank T. Campagna, 34 South 17th Street, Rittenhouse 6-4290



MODEL 824 Reid-O-Matic with push-button controls for fast selection of all grinding operations and quicker set-up and changes. Outstanding features, for production and toolroom grinding, include: finger-tip level controls, electrical components in single, sealed base housing for easy access, and adjustable gibs on head ways.



Spindle — 2 H.P., 1800 rpm. (std. cartridge type)



MODEL 618 — the standard for truly precise toolroom grinding. Features include: rugged construction with one-piece column, cogged timing belt for smooth table operation and sealed cartridge type motorized spindle for smooth chatter-free operation.

Specifications:

Capacity — 6" wide, 18" long, 171/4" high Worktable — 51" by 8" overall

Table speed — infinite variation, 12 to 35 fpm. Feed range - elevating hand wheel-to .0005";

cross feed - to .001"

Spindle - 1 H.P., 3450 rpm.

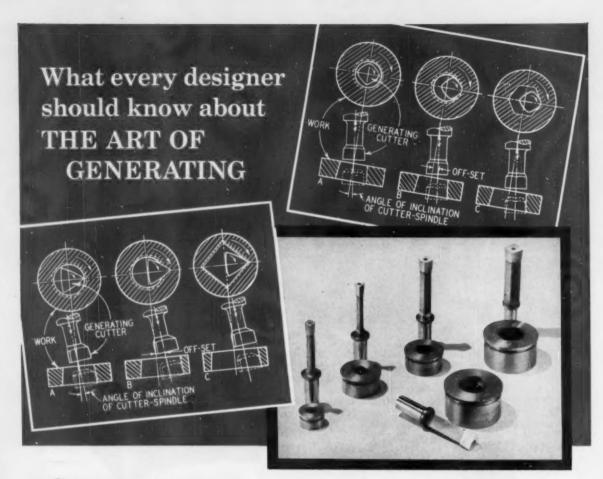
For full details and specifications write for Bulletin 800

Reid Brothers



Company, Inc.

MASSACHUSETTS



Generating offers designers many advantages in producing an almost unlimited variety of contours. Produced by the relative motions of points, lines, or surfaces, all generated profiles are combinations of two basic surfaces: curved and straight.

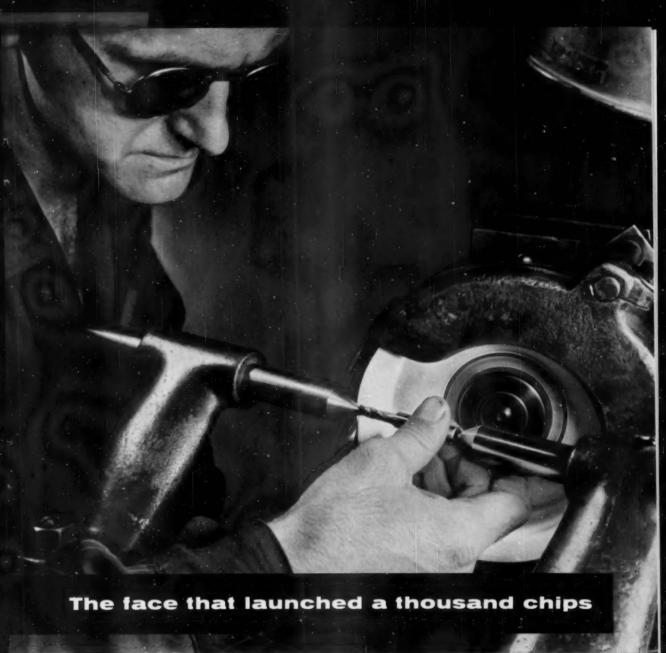
Generating with a reciprocating cutter on the Fellows Gear Shaper is a low-cost method of producing a wide range of symmetrical or irregular contours, either internal or external. Gear Shaper versatility provides a choice of generating techniques-employing a cutter form conjugate to work shape, introducing a variable movement between cutter and work, or a combination of both methods.

Shown above are some trim dies and the cutters used to generate them: three-sided cutters generate the square holes and four-sided cutters the hexagonal holes. Cutter sides are curved surfaces conjugate to the straight surfaces on the dies. The drawing shows the steps in generating. A special bed tilting mechanism in the Gear Shapers provides a simple adjustment for the required taper angle on the dies.

Many other examples of interest to designers are shown in the booklet, "The Art of Generating with a Reciprocating Tool." Just write any Fellows Office.

THE FELLOWS GEAR SHAPER COMPANY 78 River Street, Springfield, Vermont Branch Offices: 319 Fisher Building, Detroit 2 5835 West North Avenue, Chicago 39 150 West Pleasant Avenue, Maywood, N. J. 6214 West Manchester Avenue, Los Angeles 45

THE PRECISION Cours Gear Production Equipment



"Better finish-much cooler cutting —three times the production." This report on "V40" Bond Tool Room Wheels is typical of thousands received at CARBORUNDUM from tool rooms in every state of the union. Roughing end mills, finishing reamers, profiling multi-tooth cutters, backing off broaches, sharpening hobs...no matter what your job...one bond, "V40", will serve you better than any other. Wheel structure and bond combine to make "V40" wheels hold form and size longer than any other tool room wheels-cut costly down-time for dressing midway through a job. Yet the composition of the bond is such that "V40" wheels

dress quickly and easily when necessary. Call your CARBORUNDUM Distributor or salesman for a trial, and see how easy "V40" wheels are to use... with profit! For performance reports on tool room grinding, write The Carborundum Co., Niagara Falls, N. Y. In Canada: Canadian Carbor-undum Co., Ltd., Niagara Falls, Ont.

Through application "know-how" and product quality

continually puts more sense in your abrasive dollar





This new combination Swivel and Air Counterbalance attachment makes it possible to adapt large multiple spindle drill and tapping heads to radial drilling machines.

Flexible and easily adjusted, it insures maximum safety for the operator, as well as better operating economy.

Two cylinders maintain a balanced condition of the head on the machine, with the air in the counterbalancing setup being controlled on both ends of the stroke. Therefore, only sufficient pressure is maintained to counterbalance the weight of the head during all portions of the stroke. On the return stroke, the air is controlled to prevent extreme, quick return of the head. Attachment includes air filter, pressure regulator, and an air oiler, and incorporates a 360° swivel feature fully aligning the drill head. It operates equally well with the fixed center type head and the adjustable type head.

This package is ideally suited for drilling condenser plates, boiler tube sheets, flue sheets, etc.

FOR MEN WHO KNOW DRILL HEADS BEST, IT'S ALWAYS U. S. DRILL HEAD - FIVE TO ONE



Manufacturers of all types of Fixed Center, Adjustable, and Individual Lead Screw Tapping Heads.

THE UNITED STATES DRILL HEAD COMPANY

BURNS STREET . CINCINNATI 4, OHIO

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- DRILL COUNTERBORE
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ARD ISA I-8

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TAPS & GAGES

Card Taps and Gages are your best buy because quality, accuracy and long life are built in by Card, famous for over 80 years of precision tool manufacture. Always specify Taps and Gages by Card.

S. W. CARD MANUFACTURING COMPANY . MANSFIELD, MASSACHUSETTS

Division of: UNION TWIST DRILL COMPANY

TAPS . DIES . SCREW PLATES . GAGES

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A DIVERSIFIED

LINE OF QUALITY!

UNION

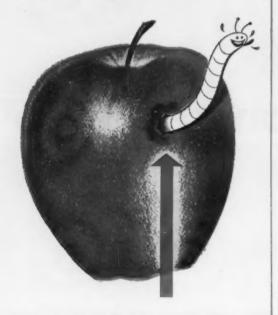


In every drilling operation there's a particular drill that will do the job for you quickly, accurately and economically.

Union offers a complete selection of top quality drills, standard and special, to suit the requirements of your job.

UNION TWIST DRILL COMPANY . ATHOL, MASSACHUSETTS

Owners and Operators of: S. W. CARD DIVISION, Mansfield, Mass. BUTTERFIELD DIVISION, Derby Line, Vermont and Rock Island, Quebec



a hole here makes waste...



a hole here saves waste

Crucible Hollow Tool Steels save waste—time and money—whenever you need ring-shaped parts or tools with a center hole. For the hole is in the piece when you get it! You eliminate drilling, boring, rough-facing operations—save machine capacity for productive work.

And you can get Crucible Hollow Tool Steels in any of our famous tool steel grades . . . in bar lengths or saw cut to your individual requirements. They are made in practically any combination of O.D. and I.D. sizes. What's more, delivery is immediate with Crucible's popular KETOS oil-hardening, SANDERSON water-hardening, AIRDI 150 high-carbon high-chromium, AIRKOOL air-hardening, and NU DIE V hot work tool steel grades from warehouse stocks.

Next time you have an application with a center hole, let your Crucible representative show you how these hollow tool steel bars can save you money and time. Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.



first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor - Railway & Power Engineering Corp., Ltd.

moving metal... BLUE ANGELS'= Style ---



JET ENGINE PART of 22 gage inconel, Hydroformed in two operations. A punch, contoured to the part shape, and a simple draw ring, were the only tools required. Hydroform machines are built in 8", 12", 19", 23", 26" and 32" sizes.

> NOZZLE, Hydrospun from a wrapped and welded tube (shown at right) of AISI 4130 steel in four passes. Hydrospun parts, having undergone a severe shear deformation, possess increased strength, hardness and resistance to fatigue.



U. S. NAVY PHOTO

With maximum separation of five feet between each plane, the "Blue Angels" demonstrate precision tactical techniques of naval aviation at speeds of 500 mph and better. This famous team of Navy pilots has thrilled millions of aviation enthusiasts with its "minimum altitude" performances of close order precision flying.

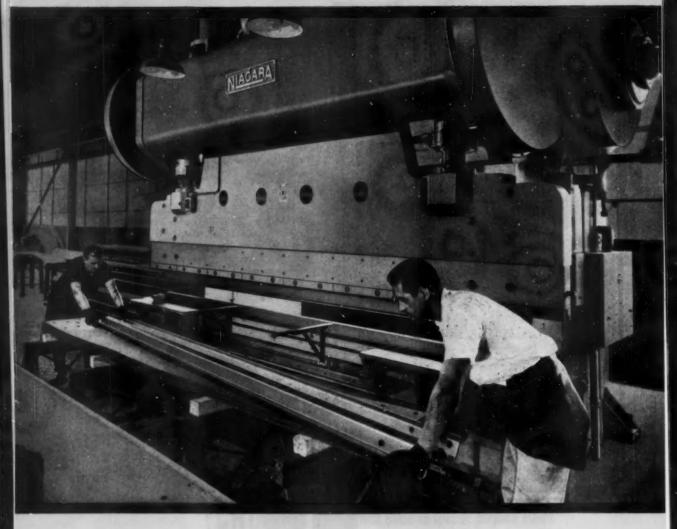
To a constantly increasing number of manufacturers, particularly aircraft and jet engine builders, moving metal by The Cincinnati Milling Machine Company's Hydroforming and Hydrospinning processes is equally dramatic. Formerly difficult-to-make aircraft, engine, missile and other components are being produced in rapid development time... with savings of 50% and more in tooling, materials and labor. These part shapes range from simple to highly complex, formed from a wide range of metals. For detailed information on Hydroforming and Hydrospinning, call in a Process Machinery Division field engineer.



Hydroform · Hydrospin

THE CINCINNATI MILLING MACHINE CO. CINCINNATI 9, OHIO, U. S. A.





(Above) Forming highway guard rails from 12 gage steel on Niagara 520 Tan Press Brake.

(Right) Piercing rails with same machine.

(Far Right) Forming chair seat trames for office furniture from 20 gage steel on Nagara 150 Ton Press Brake.

Niagara for Press Brakes"

"The personnel of our organization has been acquainted with Niagara equipment for years Niagara will stand behind any equipment furnished. Many millions of operations in the past 5 years on their presses and press brakes... equipment satisfactory from both the operational and safety standpoint. Our intention is to use the Niagara line entirely"

There in the words of one customer (a large Ohio metal fabricator whose press brake operations are illustrated), you have the sentiments of hundreds. Once experienced with any of the other metalworking machines which Niagara makes...presses, shears, bending rolls and dozens more...one just naturally thinks first of Niagara whenever the subject of press brakes comes up.

REASONS ARE MANIFOLD: (1) Extreme helpfulness of Niagara's engineers in selecting the machine and accessories that will do the job best (no other manufacturer can offer so complete and large a line of sheet and plate metalworking equipment). (2) Unrivaled reputation and experience in the field, dating back 77 years, that assure unquestioned reliability. (3) World-wide recognition for design leadership, combining rock-bottom operating economy and top-notch performance in every product it makes (take a moment to run down this partial list of imposing press brake features):

- Double end twin drive with double reduction gearing for smooth, uniform application of power at both ends of ram,
- Rugged, all-steel frames with box type crowns of unequaled strength and rigidity.
- Extra beavy, rigid bed and ram for maximum support of dies.
- Gearing totally enclosed in sealed oil baths for thorough, clean lubrication.
- · Longer lasting, laminated, nonmetallic ways.
- @ Powerful, smooth-acting, multiple disc clutch and brake,
- · Gibs maintain accurate, endwise alignment of ram,

Standardized in a complete line, ranging from 50 through 775-ton capacities, Niagara Press Brakes are built to produce a tremendous variety of work uniformly and accurately. Post yourself now on all the details by requesting Bulletin 89 D and, as soon as you can, avail yourself of some really worthwhile suggestions from a Niagara representative. Write.



NIAGARA MACHINE & TOOL WORKS . BUFFALO 11, N.Y.

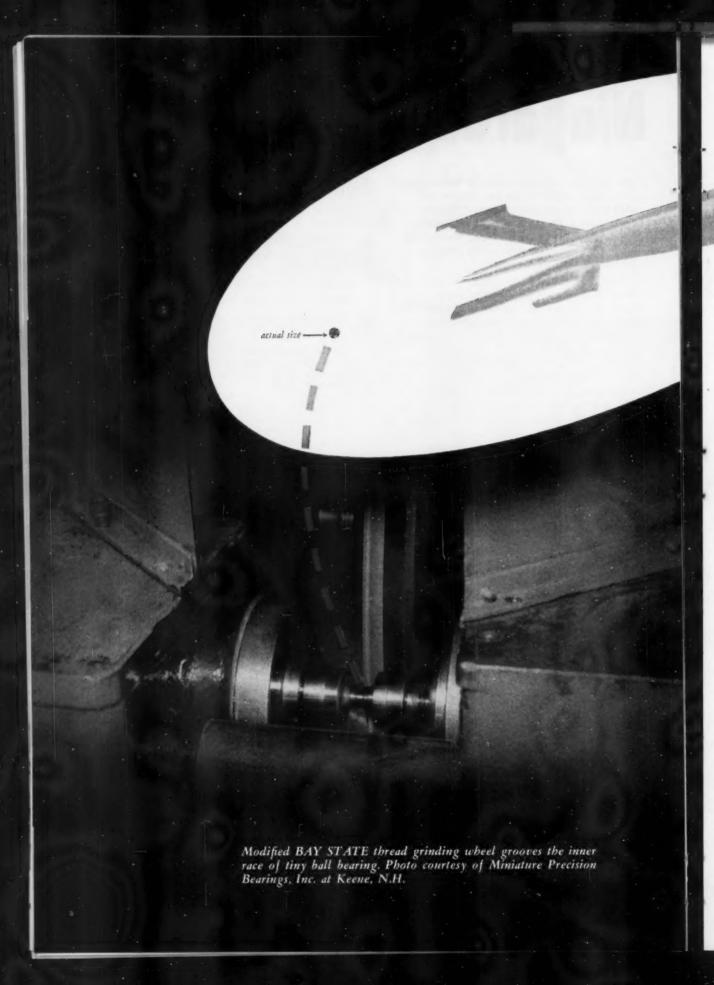
DISTRICT OFFICES:

Buffale * Cleveland * Detroit * Indianapolis * New York * Philadelphia Distributors in principal U.S. cities and major foreign countries

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work







Behind Controlled Flight... BAY STATE GRINDING WHEEL PRECISION!

Of tremendous importance to the effectiveness of guided missiles, jet planes, and other supersonic projectiles, is the *precise control* of their flight. The tiny instruments which give this control need unbelievably small bearings which must perform perfectly. One such ball bearing is shown full size on the page opposite.

Grinding such perfection into each ball-groove and face of these gem-like bearings demands grinding wheels with the most *dependable* uniformity of cutting action . . . in wheels down to the midgets which do their work *inside* the miniature bearings!

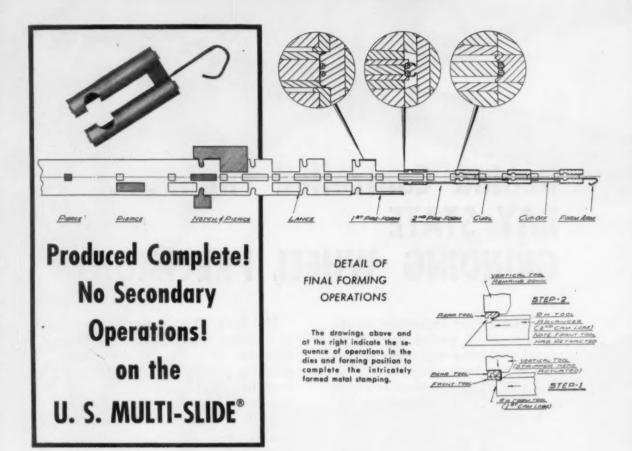
Electronic Formulation, the exclusive BAY STATE control which gives such complete grinding wheel uniformity, is one of the answers to this and many other grinding problems. "EF" uses the unerring accuracy of electronic computers to calculate precise amounts of each grinding wheel ingredient, and to "remember" these amounts on electronically punched cards.

Use BAY STATE as your source of abrasive engineering service and products to get up-to-the-minute grinding performance. Call in your local Bay State Distributor, or write directly to Bay State Abrasive Products Co., Westboro, Massachusetts. Branch Offices are located in Bristol, Conn.; Chicago, Ill.; Cleveland, Ohio; Detroit, Mich.; Pittsburgh, Pa.; with distributors in all principal cities.

In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ont.



Manufacturers of all types of Quality Abrasive Products



The intricately formed metal stamping (shown four times actual size above) is just one of the many different types of stampings which can be produced without secondary handlings on the U. S. Multi-Slide.

Eliminate secondary operations — reduce costs — increase production: You, like all manufacturers, are interested in achieving these results. In the pressroom this may be accomplished through the use of the U. S. Multi-Slide Machine. Standard machine equipment in-

cludes ram action, four slide forming position and vertical stripper movement. These various movements make the U. S. Multi-Slide a versatile machine and allow for the production of complicated formed metal stampings without secondary handlings.

Ask for a copy of Bulletin No. 15-T which illustrates and describes these machines and contains the specifications for the four sizes now being built.

#28 U. S. Multi-Slide Machine used with appropriate tooling to produce the part shown above.

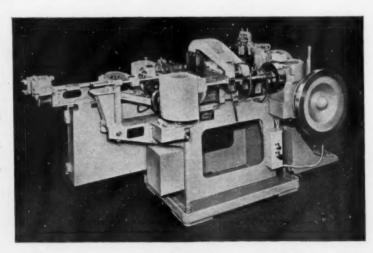
U. S. TOOL COMPANY, INC. Ampere (East Orange), N. J.

Builders of U. S. Multi-Slides

U. S. Multi-Millers

U. S. Automatic Press Room Equipment

U. S. Die Sets and Accessories



Bob Rossi, Chief Engineer, tells Roy Johnson, Plant Manager

"We switched to formbrite

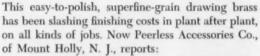


apiece!"



.032" gage 70-30 Formbrite is used for this 41/2" diameter rearview mirror head shown full size. Strip is 51352" wide supplied in heavy coils for long press runs. Copper, nickel and chromium plating on a solid brass base provides a bright, rustless, long-lasting outdoor finish.

Peerless Rearview Mirrors. "Flight-Wing," below, and the newer "Director" model, left. Housings and mounts are chromium-plated zincbase die castings.



"To our line of lighting and safety automotive accessories, we've recently added two rearview mirror assemblies. We had been using regular drawing brass for the dished head until your representative persuaded us to try Formbrite. Here are the results, based on a very careful cost study:

Finishing procedure using regular drawing brass

- 1) Grease grinding or "cutting"
- 2) Buffing
- 3) Copper strike
- 4) Nickel plate (.00045") 5) Buffing nickel
- 6) Chromium plate

Cost 27¢ each

Present procedure using Formbrite®

Not necessary with Formbrite

Light buff

Copper strike Bright nickel plate (.0003")*

Not necessary

Chromium plate

Cost 15¢ each

"That's a saving of 12 cents apiece. Multiply it by 3,000 to 4,000 a day and it becomes important money!"

*Formbrite's superfine grain made possible a lighter but equally serviceable plate of bright nickel

Surprisingly, Formbrite doesn't cost a penny more. Find out for yourself how its superfine grain, excellent drawing properties, strength, and scratch resistance can help you make a better product at lower cost. Write for Publication B-39. Better yet, ask us about a sample lot. The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

Tormorite fine-grain drawing Brass

an ANACONDA product made by The American Brass Company

OULE T

as a gentle breeze!



New ARO DULCETONE SCREWDRIVER

"Whispers while it works"

Reduce noise to a whisper in your assembly operations . . . cut down operator fatigue . . . use ARO Dulcetone Air Screwdrivers! This slim compact tool runs with a quiet gentle exhaust. Light weight . . . 1800 r.p.m. Capacity No. 8 nuts and machine screws. Dulcetone Screwdrivers now offered as standard tools . . . immediate delivery. Ask your ARO Distributor for a demonstration.

THE ARO EQUIPMENT CORPORATION

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AIR TOOLS

Also...Air Heists...Lubricating Equipment...Aircraft Products



Simplified cross-slide camming



Interchangeable cross-slide tool holders



Quick-adjusting stroke mechanism



Rapid speed and feed changes



Wide-open, easily reached tooling area



Built-in threading feed and drive



Easily accessible main toolslide holders



Stationary type collets changed quickly

eight big reasons why you get

Fast Setups

ON GREENLEE BAR AUTOMATICS

In plant after plant countless hours of setup time are saved each year on Greenlee Bar Automatics. Similar savings in time and money can be achieved in your own plant. Greenlee has on-the-job case studies to prove it. Whether your responsibility lies in the field of management . . . production . . engineering . . . or purchasing you owe it to yourself and your company to call in the Greenlee man. Let him show you why and how faster setups on a Greenlee pay off in greater profits.



WRITE TODAY FOR CATALOG A-405



4-SPINDLE...6-SPINDLE SECOND-OPERATION PNEUMATIC STOCK FEED



GREENLEE BROS. & CO. 1991 Mason Avenue Rockford, Illinois

HOW W. F. & JOHN BARNES

"Specials" Cut Costs on



Overall view of three 5-Way Machines. First machine in foreground, bores and faces 5 flange holes; second, performs 8 combination drilling and chamfering operations; third, handles 14 tapping operations. All three machines are equipped with power transfer from gravity conveyor. One operator loads and unloads three machines at pushbutton stations.

View showing workpieces in center turntable after 180° turn, ready for traversing into new machining position. Machining cycle at station 2 allows operator time for unloading and loading at station 1 without losing production time.



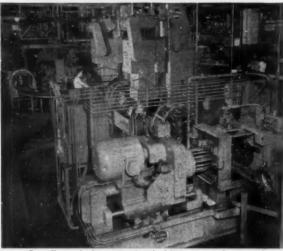


4-Way Machine with reciprocating index fixture. Left-hand two-spindle heads drill and finish-ream .750" dowel holes in both ends. Right-hand single stub-spindle heads bore, chamfer and face stator and cylinder ends.

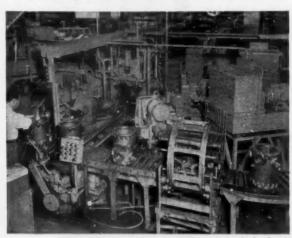
BUILDERS OF BETTER MACHINES SINCE 1872

MULTIPLE SPINDLE BRILLING . BORING . TAPPING

Low Production Work



Overall view looking toward end of line. Unit in foreground taps 31 holes in ends of piece and presses in two center bushings. Vertical machines are facing units for machining stator end and hub, and cylinder end and hub.



View of 6-Way Boring Machine for finishing five cylinder bores and two babbited bushings. Concentricity of stator and crankshaft bores is held to max. of .005" T.I.R. Babbit chips are collected in separate chip box. C.I. chips for entire line are flushed automatically to a central system.

MULTI-STATION UNITS REDUCE MACHINING TIME ON COMPRESSOR CRANKCASES 1.85 HRS. PER PIECE

At Airtemp Division, Chrysler Corporation, Dayton, Ohio, a battery of ten Barnes Multiple Spindle Machines are today demonstrating the efficiency and economy of special machines engineered to serve relatively low production requirements. Previously, the compressor crankcases used in Airtemp's fine line of large 5-cylinder commercial air conditioning units were drilled, milled, bored, faced, and tapped in single operation machines. Now, most of these operations are performed automatically in Barnes specials. As a result, machining and handling time has been reduced 1.85 Hrs. per case. In addition, close tolerances are more easily maintained which has increased product quality.

PRODUCTION GEARED TO 15 CRANKCASES PER HOUR

The Barnes Multiple-Spindle Specials are incorporated into a semi-automatic production line which is geared to produce 15 crankcases per hour. Parts are moved between machines on gravity conveyors, and operators manually position workpieces into the loading station of each machine. Powered turnover and transfer devices are included to minimize manual effort. After more than 12 months of operation, the new line has effected savings equalling the preliminary estimates of Airtemp Engineers, and at the same time has provided the additional capacity to meet an increased demand for their product with little increase in floor space.

INVESTIGATE BARNES SIX-POINT COORDINATED MACHINE BUILDING SERVICE

We suggest you investigate the profit possibility of applying Barnes special machines to your work. Find out, too, how Barnes sixpoint coordinated engineering and building services can help you eliminate divided responsibility and save time. Write for free brochure or ask for an analysis on any specific job.



W. F. & JOHN BARNES COMPANY

405 SOUTH WATER STREET . ROCKFORD, ILLINOIS

MACHINES - AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

SCULLY-JONES QUICK-CHANGE CHUCKS AND COLLETS

ASSURE GREATER OVER-ALL ECONOMY FROM YOUR MACHINES AND CUTTING TOOLS



These benefits	for these reasons	result from these PREMIUM feature
INCREASE	Change tools fast without stopping the machine.	Operator merely lifts locking ring, without stopping machine, and the collet with cutting tool drops out.
		 Operator inserts replacement collet in one easy motion. Ring falls into place by gravity, and machine is ready for next operation.
	Faster, easier ejec- tion of cutting tools from collet.	3. Exclusive keyhole-type drift slot permits ejection of tools by a simple twist of the wrist, using "Scully-Drift" or cam-type tool ejector.
REDUCE CAPITAL AND OPERATING COSTS	Minimize Invest- ment in special machinery.	4. Give multiple-spindle range to single-spindle machines used for sequence operations like drilling, counterboring, reaming, and tapping.
	Eliminate rejects.	 Locking ring holds collet firmly and securely in chuck, providing a positive drive to the two balls which are the driving mechanism.
	Reduce mainte- nance and re- placement costs.	6. Chucks are heat-treated and ground to prevent distortion and "nicking."
ASSURE SAFE OPERATING CONDITIONS	Eliminate safety hazards.	 No ears or sharp edges on lock- ing ring, and ample projection of collet, eliminate possible injury to operator when changing tools in motion.



"Precision Holding" for holding precision

Scully-Jones and Company, 1915 South Rockwell St., Chicago 8, Ill.



HOW Gives You Better, More Dependant More Dependable Carbide



HYDROSTATIC IMPACTING (Valenite Method)

Milled powder is placed in a latex bag and roughly compacted into a billet. The bag is suspended in liquid in a sealed "pressure bomb." Repeated, enormous surges of pressure compact the powder into a dense, solid billet.

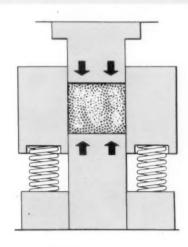
Air is evacuated from the bag before pressing. Residual air works out. No contaminating oxygen remains within the material.

Unit pressures are so high that the resulting billet is strong and hard. It is ready for machining into desired carbide shapes without pre-sintering or further

Pressure is exactly equal in all directions. Pressure surges applied over a long period break down "bridging effects" between particles. Powder compresses to maximum density throughout. The billet is equally strong in all directions; sintering shrinkage is always uniform. Tolerances can be held closely.



A scored billet formed by hydrostatic impacting looks like this after sintering.



MECHANICAL PRESSING (Conventional Method)

Loose carbide powder is poured into a die in a mechanical or hydraulic press and is squeezed to form a billet. Compacting pressure varies with the surface area of the die and over the billet in areas of unequal fill.

Air entrapped within the loose, fluffy powder remains to cause laminations and other quality-reducing diffi-

Unit pressures are necessarily low. The billet is weak and crumbles easily. It must be pre-sintered, or halffired, before it can be handled. The ideal sintering cycle for highest quality can not be used.

No pressure is applied from the sides so the billet is stronger in one direction than another. It is impossible to fill the die cavity evenly and the billet varies in density throughout. Shrinkage in sintering is not uniform; tolerances must be very loose.



A scored billet of mechanicallypressed carbide looks like this after sintering.

*This new method (one of four VALENITE advances) is the key to wider use of money-saving preformed carbides, better all-around performance





The above preformed tungsten carbide parts (shown unfinished) required little work after sintering.

You can save time and money by using preformed carbide parts

*... Valenite carbide preforms reach you faster — require far less finishing before they go to work!

Here's Why . . .

- 1. Methods like Hydrostatic Impacting (see preceding page) enable Valenite to give you closer tolerances. You cut grinding and finishing time and expensive diamond wheel usage
- 2. Through Valenite's advanced production techniques, you get premium-grade carbides (and premium performance) at no increase in price over regular carbides
- 3. At the new Valenite plant, your preformed carbide parts go into production at once without red tape delays in the office
- Valenite maintains a staff of specialists in carbide preforming. Their assistance will save you money, give you improved on-the-job carbide performance

Maybe you can save money right now on your carbide preforms, or profitably use preforms in place of modified standards. Why not send your prints to Valenite for study, recommendations and a quotation? Or ask for your Valenite field man to call.

Write to: TECHNICAL SERVICES DEPARTMENT





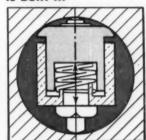
Four gages inspect all diameters from ½" to 8"

TO GAGE BLOCKS or with a micrometer...

Precise Centralization is Built-in

MODEL 1250 SERIES BORE GAGE

Positive centralization. Single plunger eliminates off-center location, assures precise alignment of centralizers and sensitive contact.



You can set this gage to gage blocks or micrometers with perfect assurance that when you place the gage in the hole the contacts will locate precisely on the true diameter.

Instead of using two separate centralizing plungers which might respond unequally to a common source of pressure, thereby making centralization inaccurate, the 1250 Series Bore Gages have a single, large, spherically radiused plunger which contacts the circumference of the hole at two points. The generous bearing surfaces assure precise movement of the plunger so that pressure is exerted equally at each point of contact, causing the gaging head to seat with greater accuracy on the true diameter of the hole.

At time of assembly, the sensitive and reference contacts of each gage are radiused precisely concentric with the plunger. This provides much greater accuracy than can be actually obtained by attempting to align a sensitive contact with two separate plungers. Even when the gage is unintentionally cocked laterally, it still holds its accurate centralization. Write for complete details.

FEDERAL PRODUCTS CORPORATION 61911 Eddy Street • Providence 1, R. I.

Ask FEDERAL First

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging



without specially trained operators

Here's easily controlled, accurate micro hole drilling at low cost!

Now anyone can become an expert micro-drill operator — because of these outstanding Dumore features that make drilling holes to .001" easy. Super sensitive feed; accurate and instant centering magnetic chuck; micrometer depth control; two-way table travel; 10-power viewer and spot light and speed control box; table drilled and tapped for holding fixtures - all combine to give you consistently lower micro hole drilling costs with less scrap.

ACCURATE INSTANT CENTERING MAGNETIC CHUCK provides fast changeover to different drill sizes without stopping the machine. Drill is set into a collet, placed against the magnetic rotating driver and quickly trued to the hole with a finger nail or a pencil point. Accurate concentric drill rotation results every time with less drill breakage and scrap losses.

SPEEDS CONTROLLABLE TO 17,000 R.P.M. provide the correct speed for any drill size up to 1/6". Available speeds permit extremely accurate drilling performance for the drill size range from .001" up to 1/8".

TEN-POWER VIEWER AND SPOT pin point the work for full, clear vision on the smallest holes.

MULTIPLE-HOLE UNIT

TWO-WAY TABLE TRAVEL PROVIDED . . Side to side and front to back — both adjustable from zero to 11/6". Two easy-to-read dials indicate travel; convenient knobs permit quick location and exact spacing between holes. Saves set-up and layout time.

only \$565.00

Model 27-021 Includes Drill Press, Speed Control Box, Viewer and Spot Light, Micrometer Depth Control, 2 Counter Balances, and Magnetic Chuck Kit. 115V, AC, 50/60 cycle.

Single Hole Unit, Model 27-011, only \$295.00 WITH STATIONARY TABLE

Has all the fine features of the Multiple-Hole Unit except two-way table travel mechanism. For single hole drilling where table movement is not required, Includes Drill Press, Speed Control Box, Viewer and Spot Light, Micrometer Depth Control, Counter Balances, Magnetic Chuck Kit. 115V, AC, 50/60 cycle.

See Your Local Distributor for a Demonstration, NOW!



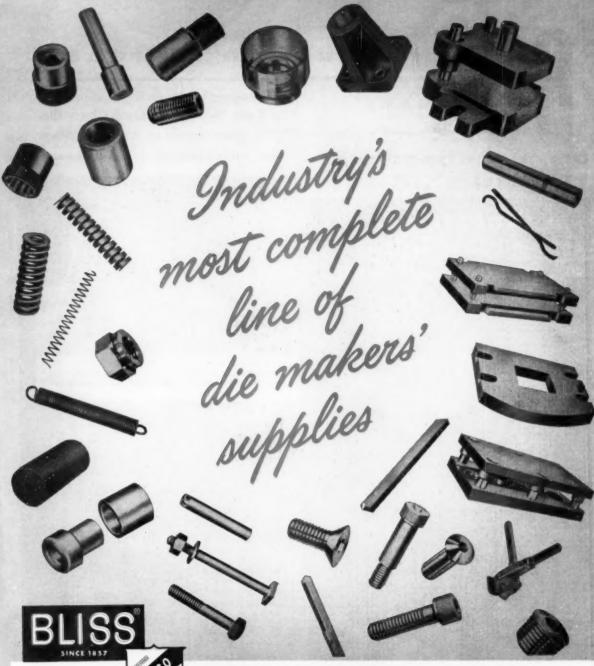








AUTOMATIC DRILL UNITS TOOL POST AND HAND GRINDERS 1310 Seventeenth St., Racine, Wis.



E. W. BLISS COMPANY

DIE SUPPLY

1400 Brookpark Road, Cleveland, Ohio

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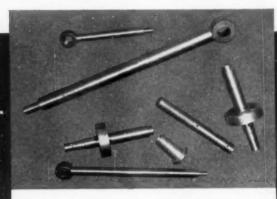
O O Production Increase

on miscellaneous
TURNING JOBS!

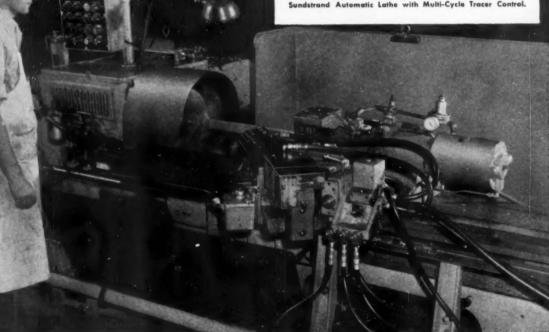
The Frank G. Hough Co. of Libertyville, Illinois, manufacturers of the famous "Payloader," use this Sundstrand multi-cycle tracer



Automatic Lathe equipped with Multi-Cycle Tracer Control . . .



Illustrated above are several parts that are machined on this Sundstrand Automatic Lathe with Multi-Cycle Tracer Control.



AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS









controlled automatic lathe for turning various parts as illustrated.

Multi-cycle single point turning of irregular shapes can be obtained quickly and easily with Sundstrand Automatic Lathes equipped with this tracer control. The lathes are provided with a template controlled tracing unit, which replaces the regular front carriage. Ruff, semi-finish and finish cuts can be made with one turning tool in one automatic cycle and with one template. The control can be set up for one, two, three or four automatic cycles depending on job requirements. The regular cross feeding rear slide can be used to square up shoulders, chamfer, etc. Cycle changing is quick and easy requiring only 15 to 45 minutes depending on job and number of facing tools required in the job set-up.

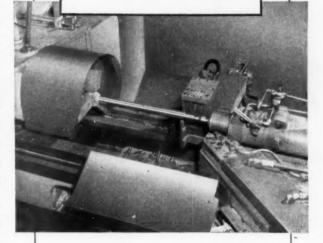
LOT SIZES VARY FROM 1 TO 200 PIECES

The 18 different parts that are machined on this lathe vary in lot sizes from 1 to 200 pieces. The ease of set up and automatic cycle make it practical to run either small or large lots.

Get these Additional Facts

This folder will give you the facts you will need to determine the possibility of applying this machine to your work.

A TYPICAL Example



This machine is a Sundstrand Model 8A Automatic Lathe with Multi-Cycle Tracer Control. This lathe performs turning, facing, chamfering and grooving operations. A total of 18 different parts, consisting of shafts, piston rods, gears, and couplings are machined on this lathe. These parts are of steel and cast iron.

The former method of machining required the use of two machines, an engine and a turret lathe. This one Sundstrand Multi-Cycle Tracer Lathe combined the operations performed by these two machines to give a production increase of 80%.

TRIPLEX RIGIDMILS

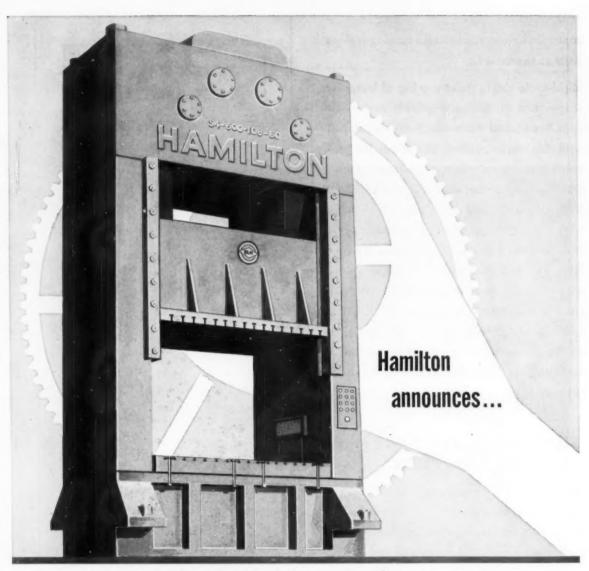






SUNDSTRAND Machine Tool Co.

2540 Eleventh St. . Rockford, III., U.S.A.



exclusive double lube protection for new top drive full eccentric presses

New from Hamilton . . . two major mechanical press developments in one . . . a complete new line of welded steel, top drive, full eccentric presses from 300 to 4000 tons . . . an exclusive new double lube system protects each press for extra-long, trouble-free service and for smoother, precision performance.

Hamilton double lube is a combination of a carefully engineered pressure oil lubrication system PLUS a complete set of troughs and gravity flow channels to provide gravity lubrication. All bearings are positively lubricated even if pressure and flow switches should fail. Double lube is double insurance against lubrication failure—a major cause of costly downtime.

In addition, this line features Hamilton's new air

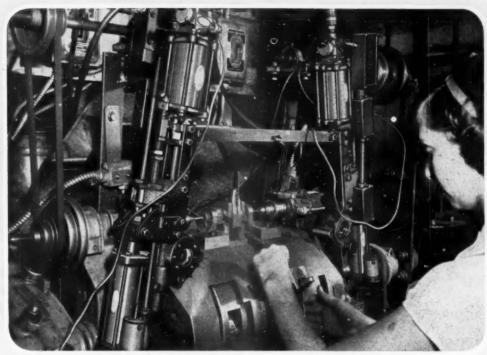
clutch, which combines all the advantages of two types ... low inertia and mechanical interlocking.

Hamilton—pioneer of the giant automotive stamping presses—meets today's demand for higher quality, faster production, less downtime. Put this know-how to work for you! Send for the full story. Write Dept 4476, Hamilton Division, BLH Corporation, Hamilton, Ohio.



HAMILTON DIVISION BALDWIN-LIMA-HAMILTON

DIVISIONS: Austin-Western • Eddystone Electronics & Instrumentation • Lima • Hamilton • Loewy-Hydropress • Pelton • Madsen • Standard Steel Works



This special machine built in the plant of Safe Padlock & Hardware Co., drills and taps turnbuckles.

It uses two Bellows Drill Press Feeds and a Bellows Rotary Feed Table. It cuts production cost 75%.

How to reduce the cost of SPECIAL MACHINES

Have you seen OPERATION PUSHBUTTON?

CONTROL DE LA CO

This half hour Bellows motion picture shows how all lines of industry use "Controlled-Air-Power" to lower costs. To arrange a showing, merely write on your letterhead. No cost. No obligation.

Address Dept. TE-1156 THE BELLOWS CO. Akron 9, Ohio. Special machines are often the only answer to lower cost production. But for short or medium runs, special machines often just aren't practical unless they are sufficiently flexible to be readily adaptable to different jobs.

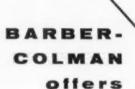
You can solve that problem of special machines by building them in your own tool room with Bellows "Controlled-Air-Power" work units. You can build them in a fraction of the time, at a fraction of the cost of expensive custom-built machines. Best of all, when the special machine has served its purpose, the basic Bellows work units can be easily redesigned into other pieces of equipment.

Bellows Field Engineers (125 of them—one or more in every major industrial area in the United States and Canada) will be glad to work with your production people in applying Bellows "Controlled-Air-Power" to your specific needs.

The Bellows Co.

AKRON 9, OHIO

precision reaming CUTS HOLE FINISHING COSTS





Close control of size and finish

Consistent duplication of accuracy

Minimum finishing stock

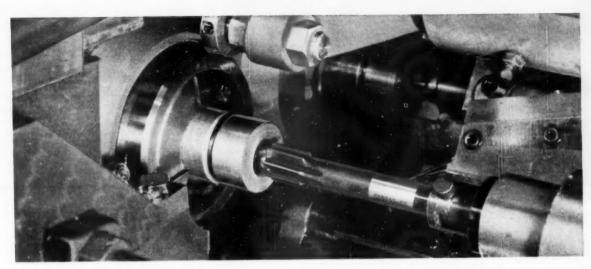
Fewer finishing operations

Important job economies are being obtained in hole finishing operations with Barber-Colman standard "oil feed" reamers. Close control of size and finish reduces the number of finishing operations required and results in shorter finishing time. Because reamer diameters are held to a tolerance of +.0002", -.0000", reamers can be drawn from stock and put to work immediately on the machines, with assurance of consistent hole accuracy. This eliminates the usual machine downtime for hand working the reamers and size checking.

Through careful tool design and accurate sharpening, reamers are made to suit the specific job characteristics, so that better cutting action produces fewer stresses, and



Barber-Colman Oil Feed Reamer



consequently less distortion in heat treating. As a result, less finishing stock is required for honing after hardening.

Cost savings benefits such as these are evidenced in the Barber-Colman "oil feed" reamers used to size bores in planetary gear blanks. Blank bores are finished within .7536"/.7543" I.D. to 15-60 rms. Since reaming produces blanks within the close tolerances required for accurately cutting the gear teeth, a series of successive finishing operations formerly required have been eliminated, greatly reducing cost per finished hole. Minimum stresses produced as a result of reaming confine heat treating distortion to normal shrinkage of the hole. Consequently, in this case, the hole is reamed to final size, and it is only necessary for honing to remove the amount of shrinkage. The job facts as shown illustrate the production accuracy and finish obtained:

Barber-Colman reamer design produces sharp cutting edges with positive primary clearance on the land, rather than a cylindrical land, to provide a shearing action cut. These sharp edges with irregular flute spacing produce smooth cutting with uniform finish and accuracy which cannot be obtained with conventional reamers. These reamers also have a slight right hand belical flute with an oil hole drilled through the center of the reamer so that the cutting oil will force the chips back between the flutes, contributing to fine finish.

Semi-Finished Bore Diameter	.7536"/.7543"
Maximum Taper Allowable	.0001"
Bore Square and Parallel with Face of Blank	.0003"/.0005"
Concentricity with O.D.	.002"
Production	200 Blanks per Hour
Cutting Time	17 Seconds
Cutting Speed	302 rpm.
Stock Reamed	.008" to .009"
Finish	15-60 rms.
Bore Depth	.820"
Feed	.025"

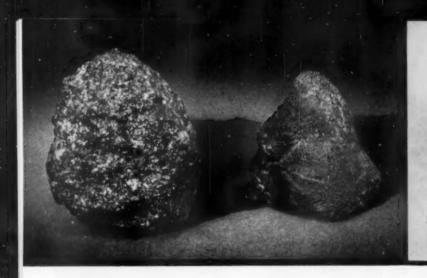
When you have hole finishing problems involving close limits of accuracy and a series of operations, call a Barber-Colman reaming expert and talk over with him the most economical way to get the finish and accuracy you want. You will find substantial production savings possible, both in cost and time.

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Different In Every Woy! New 44 ALUNDUM abrasive (at right) looks different from ordinary aluminum oxide abrasive, with a finer grained surface that denotes greater density and toughness. That's because it's made differently, by a special Norton-developed electric lurnace process. And that's why it performs differently, with new time-and-money-saving "Touch of Gold" advantages.

INTRODUCING...the NEW

ALUNDUM* abrasive



...most sensational
non-premium
abrasive
ever developed
... with new
"TOUCH of GOLD"
benefits for
better, lower cost
grinding

The big news about the new 44 ALUNDUM abrasive is this:

For a non-premium priced aluminum oxide abrasive, its performance, job range and service life are truly sensational.

It's a real work-horse abrasive — with extra ruggedness and durability that can take on a lot of tough grinding jobs and come back for plenty more.

This has been proved in more than 1100 tests. Plants all over the country have reported that 44 ALUNDUM wheels have these advantages over ordinary aluminum oxide wheels:

LONGER LIFE FASTER RATE OF CUT
COOLER CUTTING MORE PIECES PER DRESSING
HOLD FORM BETTER BETTER FINISH

Typical Reports

Centerless Grinding. "44 ALUNDUM wheels much more versatile; also, time cut on one 14-hour job to 10 hours."

Cylindrical Grinding. "More pieces per dressing and longer wheel life."

Internal Grinding. "Freer cutting, hold form better with less dressing and improved finish." Snagging. "Faster cutting, better finish, much less depth of burn."

Disc Grinding, "Coil spring production increased from 100,000 to 125,000."

Ball Grinding. "Roughing production increased 46% per wheel, with excellent performance duplication from wheel to wheel."

Thread Grinding. "Hold form better, 50% less dressing, maintain better tolerance with no sign of burn."

Mounted Wheels. "Four times longer lasting, with equal rate of cut."

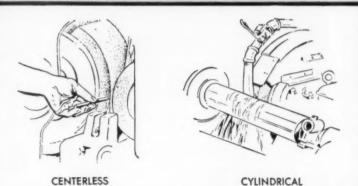
Straight Facts

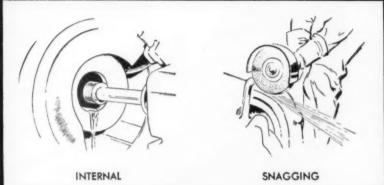
New 44 ALUNDUM abrasive is not a cure-all. For example, nothing can replace 32 ALUNDUM abrasive for precision grinding on high speed steels or CRYSTOLON* abrasive for most non-ferrous grinding jobs.

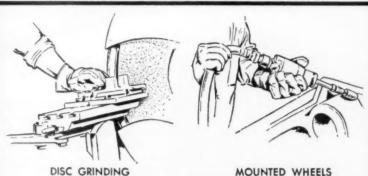
But — on any job where non-premium priced aluminum oxide abrasive is used, "44" will give results ranging from at least equal to very much better. And — "44" has a much wider job range.

Take advantage of this outstanding new abrasive value. See your Norton Distributor for 44 ALUNDUM wheels in the bonds, wheel types and sizes you need. Or write to the nearest district office of Norton Company, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. Export: Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

44 ALUNDUM abrasive gives excellent results on many grinding applications







also a standout for saw gumming, ball grinding and thread grinding.



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NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding, Machines • Refractories
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OIL HARDENING TYPE - Non-deforming, spheroidize-annealed for best machinability and consistently uniform hardenability from Simonds' own steel mill. Extra-smooth finish with all decarburization and surface defects removed. Wide hardening range. Individually packaged (18" and 36" lengths) with simplified heat treating instructions.

AIR HARDENING TYPE - Non-deforming, spheroidize-annealed, 5% chrome - more wear-resistant yet easy to machine and heat treat with uniformly excellent results — another product of Simonds' steel mill. Extra-smooth finish with all decarburization and surface defects removed. Wide hardening range. 36" lengths. Individually packaged with heat treating instructions.



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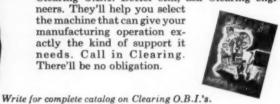
Ask Warner about their New CLEARING

Here's a big press-200 tons capacity-with big press features combined with the convenience of operation and easy feeding found in every Clearing O.B.I.

Warner Electric Brake & Clutch Company, Beloit, Wis., uses this press for drawing and forming parts for their broad line of electric clutches and brakes. They wanted quick changeover from job to job, versatility in feeding, the ability to blank or draw, automatic lubrication and variable speed drive. Their 200-ton Clearing O.B.I. gives them these things and more-hands-off maintenance, air cylinder counterbalance, motorized slide adjustment and air friction clutch and

If you want a high production machine that can take on the big jobs, ask Warner about their Clearing O.B.I. Better still, ask Clearing engi-

neers. They'll help you select the machine that can give your manufacturing operation exactly the kind of support it needs. Call in Clearing. There'll be no obligation.



This 200 ton press is equipped with Clearing's low-maintenance air friction clutch.

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The Tool Engîneer

He Appreciated

"He appreciated" is the only inscription on a weatherbeaten headstone in a quiet old cemetery. This short and homely tribute from his loved ones is more eloquent than a sermon. Was he rich or poor? Was his body strong or weak? These questions are unimportant.

We visualize a man who proudly demonstrated a life of humble gratefulness to God and his fellow men. He showed his appreciation by interest and participation in those activities and events which were most worthwhile to his loved ones, friends and country.

This month we are reminded to appreciate the sacrifices of the veterans of our armed forces. Let us remember that their successors also stand guard over our freedom. Pray that peace may prevail.

We have a privilege and duty to vote this month. Every eligible voter should register, study the issues and candidates, and vote. People in large portions of the world exist in political and economic slavery because they do not have this privilege, which too many have taken for granted. Show your appreciation of our way of life by voting!

Thanksgiving is observed this month too. Our Pilgrim Fathers and Mothers thanked God for their new-found freedom to worship and live without economic and political persecution. We can show our appreciation of their tribulations and efforts by supporting our churches and the principles of freedom.

When we become irritated with every-day troubles, we should pause to consider how well off we are. Our way of life is advanced beyond the dreams of kings and princes. Even so, it is not perfect. Let's be patient with our fellow men, remember to be grateful for our many blessings and appreciate those who have made and are making them possible. Let it be said of us that "they appreciate" too.

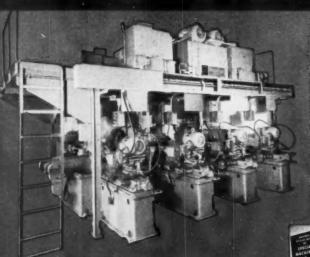
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KI

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An automotic cut-off element controls each piece. Should drills become dull causing over-heating, machine stops Each double unit operates independently—insures continued production.



Operator loads happer manually. Parts pass from happer to

This new Gun-Drilling Machine puts a precision .281" hole through 14" length of Turbine input shafts. Two drills operate simultaneously. Controls are electrically interlocked; drill #1 withdraws within $\frac{1}{2}$ " of meeting point; #2 completes the hole and withdraws. Each of the four stations handle two pieces (16 gun drills in use) . . . Production: 173 gross pieces per hour.

This booklet, showing Krueger-Barnes special machine applications will be sent immediately on request.

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DESIGNERS AND BUILDERS OF HIGH PRODUCTION MACHINE TOOLS

LABOR and MANAGEMENT

how they look at automation

labor's viewpoint

By Ted F. Silvey

management's views

By James X. Ryan

Since tool engineers have a vital concern in the total implications of automation, this exclusive symposium expressing divergent—yet surprisingly parallel—viewpoints on this subject should be of particular interest. The symposium is based on talks given by the authors at the 1956 Penn. State University automation seminar.



labor's viewpoint



By Ted F. Silvey National AFL-CIO Dept. of Education Washington, D. C.

HIGH PRODUCTIVITY in the United States comes from three drives. One is Yankee ingenuity: the imaginative, curious, roving mentality of a new country and a frontier. Second, high productivity has come from the forced growth of pure science and technology in the hothouse of war... twice in our lifetime. We have seen the telescoping of half a century of research and development during a decade of time.

A third stimulus to productivity in the United States has come from the demands of organized labor, trade union pressure for higher wages and other economic benefits. As long as workers were cheap, employers were willing to use them cheaply, but as soon as trade unions made labor expensive, employers turned to their engineers and ordered machines and equipment to take the place of men. The repetitive, trivial tasks of the speeded-up mass production line were transferred to machines. Then, even more modern machines reduced material and work-in-process handling costs; now we have instruments that guide, direct and instruct the machines.

Machines with energy are an extension of man and animal muscles. Instruments—quite more recent in their flowering—are an extension of man's five perceptive senses. One way of describing automation is to say it is a marriage of machines and instruments.

The idea of the interchangeable part, which Eli-Whitney originated, made mass production possible. Now new scientific breakthroughs make automation possible. Three things: standardization, rationalization, trivialization are included in a concept advanced by Dr. Adam Abruzzi at Stevens Institute of Technology. The older creative work of the craftsman, under these three things, turned into a repetitious, stultifying trifle of work performed at great speed, over and over again. Foremen were hired to be man-watchers and man-drivers. Under the urge of a so-called wage incentive system which was really an output-incentive system, production was operated under a combination of the stick and carrot to make men work at high speed, as rapidly as the muscles could be flexed, over and over constantly all day long in order to turn out more goods.

This obnoxious way of spending the best hours of one's life makes it desirable to transfer drudgery to automatic machinery driven by electricity. Why should anyone spend the best hours of his life putting the same nut on the same bolt, cutting the same groove in the same piece, putting the same pin in the same hole? This is a deadly business; those of us who have done it know that it is.

Consider the littleness of man's use in the mass

Repetitive work on a mass production line is often stultifying.



production system. If all the capacities of a human being could be represented by a circle the size of a washtub, that little bit of his ability that an employer bought from him for use on the mass production line could relatively be indicated by a dot the size of a pinhead. This little bit of the man was all the employer wanted. With the hopeful elimination of man's pinhead work, there is an opportunity for man to flourish in his unique capacities—things a man can do which a machine can never do. The full flowering of man's capacities becomes possible on a widespread scale.

The challenge of the new technology to engineers and management, with trade union cooperation, is to extend its function from the mere representation of owners to a broad functioning for workers, owners and consumers. Too many times in the past, management and engineers have existed solely for the purpose of representing interests of owners, to the point of exploiting workers and consumers.

An intriguing phrase increasingly found in management literature these days is "conceptual breakthrough." The words convey the idea of a smashing through walls or curtains of ignorance and limitations that have previously existed. The words also convey the thought of picking up whole new hunks of work to be done. To engineers and managers, the challenge is both within the corporation and in the whole social environment. An opinion frequently expressed is that "we need not be too much concerned about the sociological aspects of automation. They will take care of themselves." Unions are very much concerned about this, and I think that management also has to be. Here is one thing that will not automatically follow the breakthrough. We can have anarchy and confusion and social disorder.

I don't use the term "industrial revolution" in reference to automation because revolution conveys the idea of total disorganization of society. I believe that we will be able together to handle this new technology and its impact on society, organize it for the use of man, and not have it come upon us with all the dire consequences of the first industrial revolution that kept the mass of people in such misery for more than a century.

Trade unions look upon the new technology as something desirable. This is something of a new attitude. This is not universally true; there are some recesses of cultural lag in the unions, just as there are such lags in every other organization in society. But, generally speaking, the labor movement is in favor of going down the road to meet this new thing, take it by the hand and, in cooperation with other groups in society, lead it in the direction that it should go for the good of all the people.

The requirements of the new technology on all of us will be considerable. Resistance to the requirements of the scientific, technological and human aspects of this "conceptual breakthrough" will be common. Trade unions may serve as an outside consultant to top management when top management resists the economic and sociological consequences of the application of the new technology. In fact, we will be right there as salesmen of some of the new ideas.

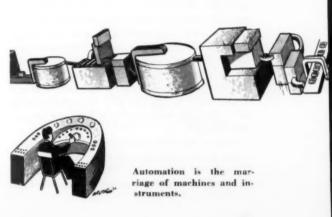
Top management has a responsibility for the internal management implications of its new technology. In addition, there are many other external implications, not only with respect to industrial relations, but to the market, to people, to all of society. Changes and the need to meet them come everywhere!

Reduced work time, along with advancing workers' wages, is high on the list of things the trade union now will be proposing. Will we have a fourday week? Alexander Heron, vice president of the Crown Zellerbach Paper Corp. of California, has stated in a professional magazine article that 15 percent of the business done in the state of California is a result of the 2-day weekend. Such things as the purchase of garden tools, shrubbery, flowers, picnic equipment, sports clothes, travel accounterments, and all the hobby and spare-time activities make new business. I cite this in connection with the four-day week because it will help business in the same fashion.

Of course there are other ideas. For example, we might maintain the work week and shorten the work year. This shorter work period will have to be negotiated. Human beings need a certain amount of ordered discipline during the week; they need ordered work for their personal mental health.

Then there is the problem whether the shorter work week will prompt workers to take a second job—"moonlighting" it is called. This is not what we're trying to do. People ought to have a good block of leisure time. I am somewhat in favor of four to six-weeks' vacation at a time rather than a shortened work week scattered throughout the year.

Then, of course, there is the management point



that plants will need to shut down because they will turn out so much that they will produce beyond even an adequately high market. A management friend suggested that extensive alteration, maintenance and repair work may be necessary to some of the machinery and we need long shutdown periods to do it.

Engineers' emphasis has focused on direct labor costs savings in automation. When you throw people out of work, you destroy customers who are the absolute imperative of automated production. Emphasis can be put on other than direct labor savings. Two such items are material savings and quality control. There are savings to be made in these areas which may extend beyond those possible in direct labor.

The trade union has some ideas with respect to this problem of displacement of workers. We propose labor-management committees to discuss the installation of automation equipment. We would like to come to management and say "Look, we don't care how fast you install automation, but when you put the sledge hammer to the old equipment, remember you are not going to put the sledge hammer to our members. You can smash up the old machinery and treat it as junk, but not our people." Thus, we are talking about how to accomplish the transition. Please receive favorably, proposals of labor union people to come in and talk about this matter.

Another thing is the amortization of more than the cost of the machinery. If you buy expensive equipment that costs many times what the old cost, it's cheap even if it's high-priced because you can amortize it with so much more production. When you follow the established practice of amortizing the cost in the selling price, you ought to do one thing more. Whatever needs to be done for the displaced workers, should be calculated by collective bargaining and that cost should be added to the cost of the equipment. Amortize it all together.

Then, there is the question of markets. New management responsibility includes putting enough money in people's pockets to buy what machines can make. Machines can do almost everything except buy what they make. So, we have the guaranteed annual wage item. The point is, once in operation, the automation system can't shut down during its production cycle. Down time is outrageously expensive. A system of banking has been built into transfer machines so that if one station is out of function, you can pick up work-in-process out of the bank and carry on without stopping the other stations.

Another one of the requirements of the new technology is that engineers must more definitely be integrated into management. This is a new kind of problem. The engineer has been used to looking at things from a strictly factual point of view. He deals with exact specifications. Management deals with all kinds of complexities, often using what they call a "hunch system." Between these two extremes lies the ideal system.

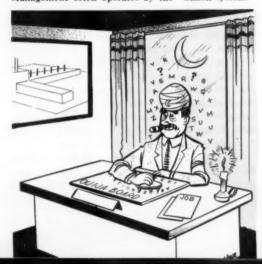
You are going to have a merger of the two kinds of traditional skills into some kind of new management skill, and in this, the younger engineers will have a large and important role to play.

There are other problems introduced by automation, such as educational and skill requirements. The new and higher skills often cited in this connection are going to be needed by a relatively fewer number of people in factories. Are the semiskilled and unskilled going to be shut out? How are they going to be retrained?

Our already inadequate educational system will be faced with real problems in training and education. Moreover, before the engineers, scientists and teachers demanded by the new technology are supplied, important changes must be made in our value judgments. We must give a great deal more effort and money to the support of public education, even if we have to give up some of the fancier aspects of our living to do it.

To summarize the union position, let me quote the declaration of the Indiana CIO summer school program at Purdue University last year: "To reconcile the technical achievements of modern society with the dignity of the men and women who compose it is the problem of our time. To reach a solution we must first be certain of the aim we set our mammoth communities and our world-wide corporations. When the last superlative has been uttered, the test must be the same-how far they contribute to the happiness, understanding and liberty of the ordinary man. The real measure of a modern industry is its power to preserve our human values while adding to our material heritage. Man is not just another factor in the productive chain-he is the reason for its existence.'

Management often operates by the "hunch system."



management's views



By James X. Ryan Regional Manager National Association of Manufacturers Philadelphia, Pa.

When management considers automation problems, it should study production costs as well as market potential. As with any plant change or improvement, management must think of the money involved. Profits have remained the same for about the last 50 years; that is, about the same amount out of the sales dollar. In the past ten years, however less than 4 cents of this dollar is earned profit, because of increasing taxes.

There are many factors that affect what happens to improvements in productivity.

Most engineers are familiar with the Evans flour mill. Back in 1784 it was about as automatic as possible. It consisted of a series of conveyor belts run by water power from beginning to end of the process, and was an absolute failure. There was no market for that much flour at that time.

Around 1801 Jacquard developed a textile machine that was run by punch cards. It was successful. There was a market for the product.

Take mechanization in the automotive industry. We can afford automobiles because we have mechanization. Yet a completely automated automobile factory is impractical because of another factor in the profit figure. If a plant is completely automated, what happens tomorrow if someone comes out with an entirely new, free-piston or turbine engine, or the market demands a radically new design?

Will we have completely automated plants or will there be people there to maintain them—people who have been upgraded? The optimum degree of automation that is economically feasible will depend on the condition of the market and on the number of competitors producing the same type of goods. In addition, management must consider the human factors. The triangle of plenty, which once was popular, shows management in the middle. On one side are the people who are going to buy the goods; on the second side of the triangle are the people who produce the goods; and on the third side the owners of the business. This illustrates the fact that management must satisfy all three groups.

Next, let us consider forward planning. By 1975, we may have 220,000,000 population. If we are to maintain the same living standard in 1975 we have today, we must raise our gross national product from 375 billion to a tremendous 858 billion. The Joint Congressional Committee on Economic Reports has heard testimony that about 40 percent more people will be in the labor market at that time,

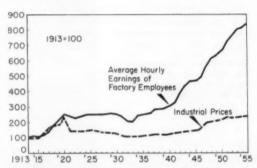


Fig. 1. Mechanization partially offsets the effect of higher wage costs on price of products produced.

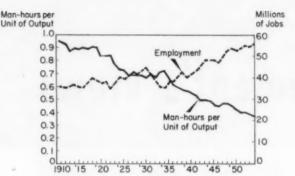


Fig. 2. Jobs increase with labor-saving improvements. Employment his risen while man-hours per unit of groduct have dropped.

to produce 178 percent more goods. By 1965, we will have about a 40 percent more demand for goods and only a 15 percent increase in the labor market. The obvious conclusion: we will need an increased productivity per man. In order to get it we will need more automation.

To continue with this study, which is the most thorough to date, testimony given before the committee indicates that automation is applicable in the near future to less than 8 percent of the industries in America. Since these industries utilize about one-quarter of the labor force, apparently less than 25 percent of the labor force will be affected by automation. The greatest extent of mechanization has occurred since 1913. Since that time the average earnings of factory employees have risen 746 percent, Fig. 1. Actually, costs in this same period of time have increased 132 percent. Without mechanization it would be logical to assume that costs would have increased the same percentage.

Backbone of expansion has been the improvement of tools and techniques to make our jobs easier. It has made it possible to produce more goods for more people at less cost. All this growth has come through freedom and incentive—freedom to do as we wanted, freedom for the manufacturer to invest capital where he wanted and freedom for us to go where we wanted. Those are the things that we cannot restrict or control if we expect automation to continue to meet the demands of our public.

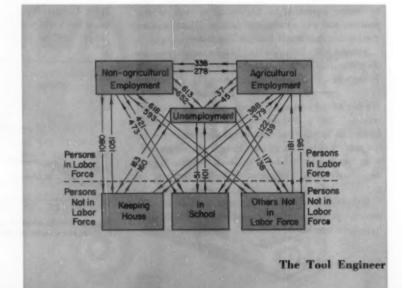
With the accelerated population rise and relatively smaller work force, a population redistribution is under way which has a compound effect on the labor market. This is due to medical advances, a longer educational period and similar factors. There will be relatively fewer people to produce more goods for more people in the future. The answer is automation.

Actually, from management's viewpoint, we have a fear but it is not displacement of people. Technological advances have always made more jobs, Fig. 2. We are concerned, however, that we may not always be able to produce enough goods to maintain the same high standard of living that we enjoy today.

The demand is for higher wages, whether in the form of fringe benefits, supplemental unemployment benefits or longer vacations or shorter work week. We agree that those are all good things, though we may differ in how they should be secured, whether through individual effort or through government help. But the only way we can have them is through increased productivity.

Management views increased wages favorably—in looking at that side of the coin—provided productivity is high enough to allow it. Back in 1940 wage rates were half of what they are today. About one in every six persons was employed. There was less need for mechanization. Today, with more than double the wage rates, we have the highest employment we have ever had in the history of this country and also the highest standard of living. This favor-

Fig. 3. Millions of job changes occur every month as this chart of typical monthly changes in job status shows. Figures are for thousands of persons and chart is based on data for the year 1952.



able climate still exists and promises to continue. The only sour thing from management's viewpoint is that wages may increase faster than productivity. If the savings of productivity can be passed on to the worker, fine.

Without higher productivity, people have less purchasing power and cannot buy enough manufactured goods. Getting the benefits of productivity back in the pockets of the workers is a problem that management recognizes and wants to do something about.

The personal benefits of automation which most people know are safer and healthier working conditions, better opportunities and less monotony. The 4-day work week may be an ideal thing and perhaps we can have it through automation.

Technical Education Needed

Meanwhile, the basic problem facing industry, the union and the public at large, is what specifically should be done. We all agree it is necessary to upgrade people.

Industry today is having reschooling periods in its own plants. For instance, there are job utilization studies where a displaced man is taken from plant B and placed in plant C. When training is needed it will be done within the plant or within the already existing school system. If schools are slow to do the job, it behooves us to see to it that the public knows what is needed and that people are trained that way.

The plant can do the job; the existing school system can do it and the union can do it. When a new machine comes along that may even temporarily displace someone, a new job will be found and he will be trained for it under the job utilization studies. All of these factors, the competitive picture and the education needs, will make the development of automation fairly slow. It is not going to affect a tremendous number of people overnight.

In such discussions sometimes we put the cart before the horse, worrying about what we are going to do after we install automation. Actually, the first thing to worry about is where to get the people to operate the machine after it is in, Technical education must precede much of the machine installation.

In one case, reports tell of a tremendous unit operated with only 30 girls. The work formerly had required something like 550 people. Actually, the company has included over 400 maintenance people and engineers in the same department, so the result is only a slightly smaller number of people.

When we scrutinize industrial employment, we find one major employer who indicates that in the past two years 40,000 new employees were hired to replace those who have quit, died or retired. Also, 33,000 have changed jobs because of promotions, technical changes or normal shifts in the work

force and similar reasons.

This is typical of all industry, Fig. 3. Each year there is about a $2\frac{1}{2}$ percent change in the labor force. That rate is faster than the period of change in 1943 to 1948, the fastest previous turnover. Over the next 20 years over 50 million people will be involved. That represents more than the total number in manufacturing today. Considering the continually shifting picture in employment, Fig. 4, it is apparent that the real problem is to use existing facilities, to retrain people and help them into better jobs.

In an effort to assist manufacturers, NAM is encouraging retraining and transfer of employees, getting the training where necessary through company expense. In some places the transition may be a little bit slower, but we expect it will continue and grow as a practice in all industry.

Although the growth of automation may be slow, we expect it to meet the increasing demands of the mass of population and the relative reduction in the

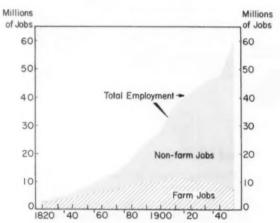


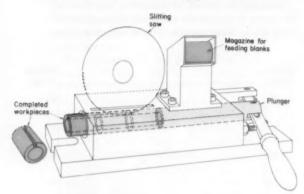
Fig. 4. One field of employment declines other employment opportunities increase.

labor force. Mr. Philip Murray, a respected labor leader, said the same thing, "I do not know of a single solitary case where a great technological gain has taken place in the United States of America, that it has actually thrown people out of work. I do not know of it, I am not aware of it, because the industrial revolution that has taken place in the United States in the past 25 years has brought into the employment field an additional 20,000,000 people."

What engineers and designers are doing in manufacturing today will assure America's continued strength, its continued growth and continued advancement of living standards. Engineers have and will make more and better jobs, more opportunities, more and better industries. Management always has and will continue to take care of its own employees.

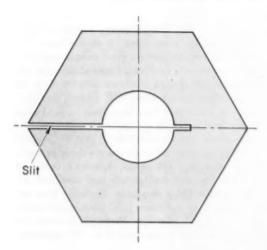
Continuous Feed Slotting Fixture

Machining a single external slot or keyway in a large number of small bushings on a conventional horizontal milling machine can be speeded through the use of the special fixture illustrated. Previously, a gang fixture was used. The production rate was low because of the time required for loading and unloading and the necessity of returning the table of the machine to the starting position each time a



Stud Holder

Protecting threads on one end of a stud from damage when the stud is held in a lathe dog for threading the other end can be a troublesome problem. Methods sometimes tried include winding wire around the threads or placing copper sheet between



group of bushings was milled. These delays were eliminated through the use of this relatively simple fixture which permits almost continuous hand feeding. Bushings are loaded into a magazine feed by the operator. A hand-operated plunger feeds workpieces through the cutter.

The fixture is of welded construction. A longitudinal guide hole is drilled and reamed through the fixture base. A recess, milled through the top of the fixture base and into the longitudinal guide hole, accommodates the slotting cutter. The ejection end of the guide hole is counterbored to receive a slotted bushing into which a key is sweated. The key keeps the workpieces aligned until they pass completely through the cutter. An adjustable stop controls the extent of forward movement of the hand lever which actuates the plunger. Since the workpieces are bronze, no coolant is provided. Compressed air blows out the chips.

H. J. Gerber Member-at-Large Stillwater, Okla.

the threads and the lathe dog. Neither of these methods is wholly satisfactory.

One successful method of protecting the threads is to screw the end of the stud into a specially prepared nut which is inserted in the lathe dog. The nut used must have threads of the correct size to accommodate the stud. It is advisable to chase the ends of the threads through with a new tap to make sure that they are the exact size required. A slit is cut in the nut as illustrated. The cut can be made by a hacksaw with two blades inserted in the frame, and should be started at one of the points of the nut. The distance the cut is carried into the opposite side of the nut will vary with the size of the nut.

When the lathe dog is tightened down on the nut, the nut is slightly compressed, clamping the stud in place without damaging the threads. If the nuts are saved after each use a complete set of prepared nuts for common thread sizes will eventually be accumulated.

Philip E. J. Brooks College of Engineering University of Missouri Columbia, Missouri

Index Milling Fixture

Often when milling evenly spaced slots the percentage of scrap is high due to human error in indexing, and for the same reason fixtures and cutters are sometimes damaged. The automatic indexing fixture illustrated eliminates troubles associated with hand indexing, and can be used to advantage on either a manually operated or semiautomatic cycle milling machine.

The fixture is designed for cutting eight evenly spaced slots in a workpiece. Indexing is initiated by a pawl and ratchet mechanism linked to an actuating lever which is in turn activated by a roller mounted on the machine column. With the fixture clamped to the machine table, the actuating lever is in continuous contact with the roller during the longitudinal movement of the table.

When the table approaches the load position, the roller depresses the actuating lever, moving the pawl into position to engage the next ratchet tooth and also disengaging a locking pin. As the table moves in the opposite direction at the start of the next cycle, the lever returns to its normal position, causing the pawl to rotate the work spindle. Simultaneously, the locking pin is released so that it is free to lock the work spindle in the next index position. The locking pin is spring loaded. Since indexing is performed during the normal operating time of the machine, no time is lost through indexing between cycles.

W. R. Eldridge Little Rhody Chapter

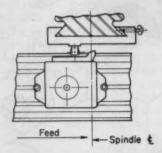


Table Position at Start of Feed

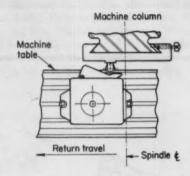
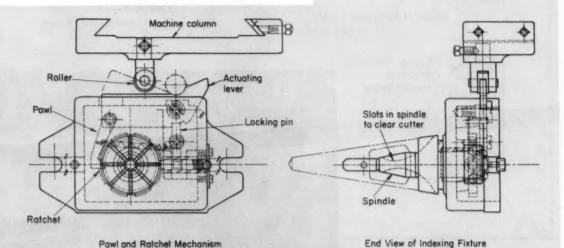
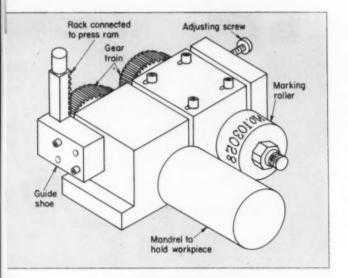


Table Position at End of Return Travel



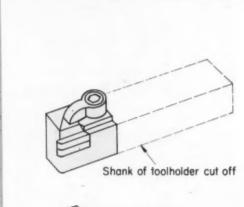
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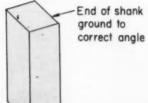


Marking Device for Tubing

When necessary to stamp numbers on parts made of thin-walled brass tubing no marking machine was available, and it was decided that the best solution was to build a marking roller device for use in a foot-operated press. The working parts consist of roller which acts as a mandrel to hold the parts and a marking roller having the same OD as the work-piece. A gear rack connected to the ram of the press actuates the two rollers through mating gears. Use of coarse pitch gears permits the spacing of the rollers to be adjusted a small amount to control the depth of the impression.

Ernest Jones Bronx, N. Y.



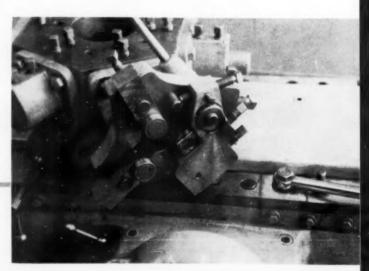


Box Tool with Throwaway Inserts

Throwaway carbide inserts can be employed in roller turner or box tools by a relatively simple conversion of a standard right-hand replaceable insert toolholder of appropriate size. The shank of the toolholder is cut off and the end is ground to the correct angle and brazed or silver soldered to the bottom of the head of the toolholder, as illustrated.

Inserts can be rotated or replaced while the toolholder is fixed in the box tool. The time saved soon pays for the conversion.

Carl F. Kaiser Santa Clara Valley Chapter



Gadgets

High-Speed Fixture for Grooving

Shallow helical grooves in small workpieces are cut in one pass on a standard lathe, using the fixture illustrated, which operates like a chasing lathe. Engagement of a nut segment with a master lead-screw mounted on the same axis as the workpiece automatically brings the cutting tool into contact with the work surface. The nut and tool travel along together to generate a helix on the workpiece corresponding to the thread on the leadscrew. Depth of the grooves is 0.012 inch and they are one-sixteenth inch wide. Ends of the grooves run into full depth gradually.

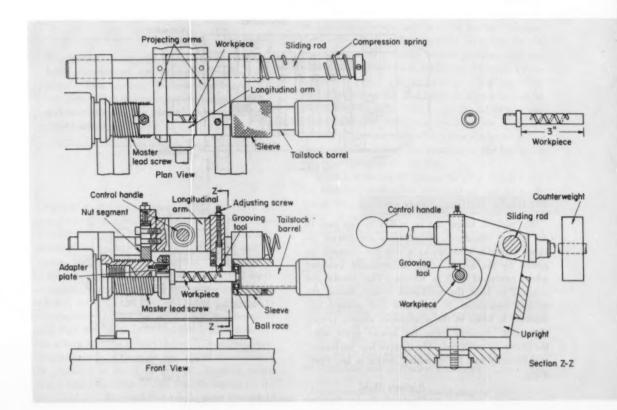
Both the nut segment and a grooving tool are mounted on a longitudinal arm above the work-piece, as shown on the plan view. The grooving tool is made of one-fourth inch square high-speed steel and is ground to avoid interference on the flanks. An adjusting screw is used to set the tool for the required depth of cut.

The longitudinal arm is part of a welded frame assembly shown in section Z-Z. Two uprights bolted to the lathe bed support the frame, which pivots and slides longitudinally on a rod. When the handle

of the frame is pulled down, the nut segment and master screw engage. A counterweight lifts the frame up when the handle is released, and a compression spring mounted on the rod pulls the frame to the right when the nut is disengaged so that the frame is always returned to the starting point when the operator's hand is not on the control handle.

The front end of the master lead screw is recessed to accommodate a hardened steel adapter plate. A keyway in the end of the workpiece engages a key in the adapter plate, holding the workpiece for driving purposes. The internal diameter of the adapter is a snug fit on the OD of the workpiece.

An angular contact ball-race, press fitted in a sleeve, is mounted on the end of the tailstock barrel of the lathe and holds the other end of the work-piece. The tailstock barrel screw and handle are removed to allow the barrel to slide freely in the tailstock body. Parts are loaded into the fixture keyway end first. The tailstock barrel is brought to the left to hold the other end of the workpiece and is locked in place. Cutting operations are accomplished by starting the spindle and pulling down



Gadgets

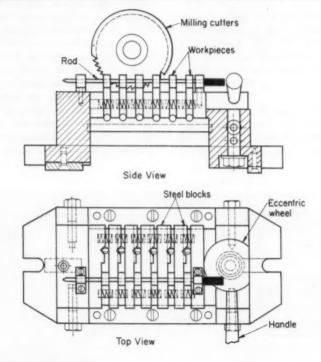
firmly on the control handle. This engages the nut and master screw and the tool plunges into the workpiece and travels to the left until the oil groove is cut.

Sloping shoulders on the ends of the master lead screw control the tool at the ends of the groove. When the control knob is pulled downward, the nut segment slides down the shoulder until the threads engage. At the end of the travel on the thread, the nut is lifted by the shoulder on the other end of the

screw. The master screw is made from an unhardened high tensile strength steel, and the nut is made of phosphor bronze.

Cutting the groove takes only one or two seconds at a spindle speed of 180 rpm. Most of the cycle time is consumed by loading and unloading work-pieces. Production is 120 components per hour.

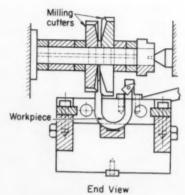
C. T. Bower London, England



Multiple Milling Fixture

Six padlock hasps can be milled in one pass in the fixture illustrated. Workpieces are placed between movable steel blocks which are clamped together by the action of an eccentrically mounted wheel equipped with a handle. The blocks are notched to hold the workieces firmly during the milling operation. A hardened and ground rod inserted in holes in the workpieces assures proper alignment. Springs force the blocks apart when the clamp is unlocked. The fixture has performed satisfactorily and the clamping device is fast operating.

Hjalmar Dahl Upplands Vasby, Sweden



how to pick

the economic lot size

By Edward C. Varnum*

Head, Operations Research Barber-Colman Co. Rockford, Ill.

Production costs and inventory costs are both dependent on manufacturing lot sizes. The author describes a method for determining economic lot sizes without introducing the bias of any one plant department.

In every plant there are two groups who have opposing views regarding the correct size of lots for inplant manufacturing. The financial group is vitally interested in inventory figures, both stock and inprocess, and consequently feels that lot sizes should be small to reduce the amount of money tied up in inventory. The production group, on the other hand, is keenly aware of the time and expense required to manufacture the first piece of a lot and therefore feels that once a lot is started the machines should run a long time to reduce the setup cost per piece. Naturally, each of these groups has an awareness of the problems of the other group. Financial people realize that shipments and production constitute the life blood of a firm and that single-piece lots would

hinder shipment and production rates. Tool engineers can visualize the dire financial effects of tremendous lot sizes.

In order to reach an unbiased compromise between the conflicting viewpoints, it is necessary to take an over-all view, one in which neither influence dominates. Such a dispassionate view can be obtained by using a coldly factual mathematical approach. A mathematical model can be made by expressing the total cost per piece as a function of lot size in an equation. The same relationship can be depicted as a graph, Fig. 1. As the setup cost per piece decreases, the inventory cost per piece increases. The composite cost curve drops to a low point and then rises. The location of the low point indicates the economic lot size.

Because it would be tedious to plot such a curve for each lot, reasonable assumptions can be made about the opposing influences on the total cost per piece. A mathematical formula can be written to correlate these assumptions. By operating on such formulas with differential calculus, it is possible to determine the lot size for which costs will be minimum.

This procedure is an example of the technique of "optimizing" mathematical models, which characterizes operations research as it is applied in solutions of problems on industrial decisions. A similar application, previously covered, concerns machinery replacement for which the opposing influences are amortization and operating inferiority. Linear pro-

^{*}Senior member ASTE Rockford chapter See the tool engineer, June 1953, pp. 70-74.

Nomenclature

b = consumption during lot production time, pieces

c = value of each piece, dollars

d = minimum quantity in stock, pieces

k = annual carrying charge per dollar of inventory, dollars

L = lot size, pieces

m = monthly consumption, pieces

P = lot production time, month

S = setup cost per lot, dollars

T = constant travel time during lot production, month

v = ratio of machining time to lot size, months per piece

y = costs per piece, dependent on lot size, dollars

graming is an optimizing technique in which there is more than one independent variable. The function to be minimized is, however, much simpler than those of the preceding examples because it is a linear combination of the independent variables.

Model Assumptions: In order to derive a general formula from which to calculate economic lot sizes, various assumptions must be made. These must be thoroughly considered before the formula can be applied to production in a plant with its own specific circumstances.

It is assumed that the number of pieces required each month, m, is a known constant. A minimum number of pieces, d, will be maintained in stock at all times. This provision for a reserve introduces higher inventory costs but these are justified when the consequences of running out of stock are considered.

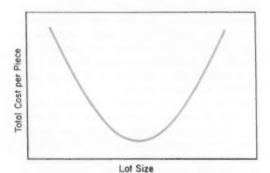


Fig. 1. (above) Because of the interaction of setup costs and inventory costs on lot size, there is only one economic manufacturing lot size for given conditions.

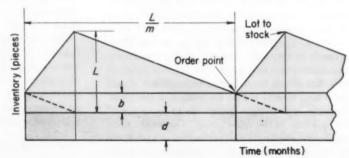
Fig. 2. (right) Graphical representation of the production and use of parts is a cyclic curve bearing a direct relation to the order point.

Another assumption is that inventory increases uniformly from the time the lot is ordered until the entire lot is sent to stock. This assumption averages out the actual process which consists of intermingling machining time and travel time. The maximum inventory at any time will be the number of pieces in reserve, d, plus the number of pieces in the lot, L. It is also assumed that inventory decreases uniformly from the time the entire lot is sent to stock until the time a new lot is ordered. This is an averaging assumption that reflects actual usage rather than recording it.

It is assumed that the carrying charge is proportional to the dollar value of the inventory. The value of the inventory can be determined easily from the known value, c, of each piece. The setup cost for a lot, S, is known but it is independent of the size of the lot. The setup cost per piece does depend on the lot size.

The total time required to process a lot depends on the size of the lot. At first, this required time in months is denoted as P to indicate that it depends on the lot size in a general way. In the later calculations, the total time required to process a lot is assumed to be a constant travel time T, added to a machining time, vL, which is proportional to lot size. Travel time depends, generally, on the number of operations.

Determining Carrying Charges: The total carrying charge depends on the value of the pieces involved times the number of months each is kept



times ${}^1\!\!/_1{}^2$ of the carrying charge rate. To compute this total carrying charge, a graph of the number of pieces contributing to this charge, based on the foregoing assumptions, is plotted against time, Fig. 2. In accordance with the assumptions, this curve is periodic. There will be an area under the curve, shown shaded and in color, associated with each lot. This area represents the mathematical product of pieces times the number of months. To find the average number of months during which a carrying charge applies to a given piece, it is only necessary to divide the area under the curve by the number of months between order points. If this quotient is multiplied by c and then by k/12, the carrying charge per piece can be found.

The under-the-curve area in Fig. 2 is found by considering it as a triangle with base L/m and height L - b placed on top of a rectangle whose base is L/m and whose height is b+d, where b is the number of pieces used during the lot production period. At the usage rate of m pieces per month, b is simply mP. The shaded area, A, is expressed by:

$$A = \frac{L}{m} \frac{(L-b)}{2} + \frac{L}{m} (b+d) = \frac{L}{2m} \left[L + mP + 2d \right] \dots (1)$$

Dividing this area by L and applying the carrying charge rate, the carrying charge per piece is:

$$\frac{kc}{24m}\left[L+mP+2d\right]....(2)$$

Best Lot Size: Since the setup charge per piece is S/L, the costs per piece that depend on lot size are:

$$y = \frac{S}{L} + \frac{kcL}{24m} + \frac{keP}{24} \dots (3)$$

The last term in Equation 2 is omitted in Equation 3 because it does not change with lot size. Labor, material and other costs not related to lot size are also omitted because only costs pertinent to lot size have any influence on lot size.

If the curve represented by Equation 3 were plotted, the minimum value of y and the economic lot size could be determined by inspection. It is even easier to find the value of L for which y is a minimum by setting dy/dL equal to zero and solving for L. Carrying through this procedure results in:

$$\frac{d\vec{v}}{dL} = -\frac{S}{L^2} + \frac{kc}{24m} + \frac{kc}{24} \frac{dP}{dL} = 0 \dots (4)$$

In general, if P is an involved function of L, Equation 4 would be solved by substituting various values of L into the left member until a value sufficiently close to zero was obtained. Under the simplifying assumption that P = T + vL, however, v.

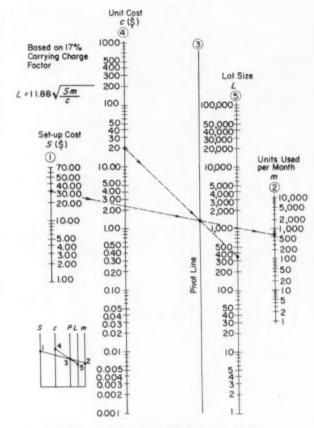


Fig. 3. Nomogram for determining the economic lot size based on a 17 percent carrying charge factor.

can be substituted for dP/dL and Equation 4 can be solved explicitly for L:

$$L = \sqrt{\frac{24mS}{kc(1 + mv)}}$$
(5)

Calculation Methods: To evaluate L in Equation 5, the numerical values of m, S, c and k (1 +mv) are found and the indicated mathematical processes are performed. Of the many ways in which this calculation could be performed, it has been found convenient to make a nomogram, Fig. 3, by which the value of L can be quickly found with sufficient accuracy.

The various factors that make up the value of k include return on investment rate, storage costs and pertinent handling charges. From a study of historical data, the (1 + mv) factor can be set up as an average figure and the whole factor, k (1 + mv), can be used as a constant in the nomogram. In the nomogram of Fig. 3, a value of 0.17 is used for this factor. Other methods of evaluating L from Equation 5 include special-purpose slide rules, ordinary

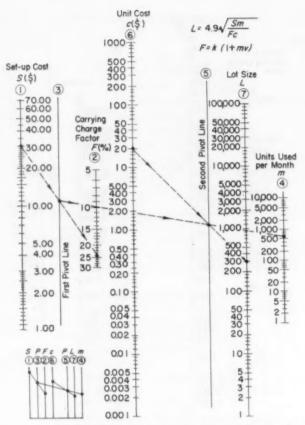


Fig. 4. General-purpose nomogram for determing the economic lot size where the carrying charge factor can vary from 5 to 30 percent.

slide rules, long-hand calculation, desk calculator operation or digital computer programs. The latter method can be combined with punched cards when numerous calculations must be made.

To use the nomogram with the 17 percent factor, a straight line is drawn from the setup cost on the S scale to the monthly usage figure on the m scale. From the unit cost value on the c scale, a straight line is drawn through the intersection point of the first line and the pivot line. When extended, this second line will indicate the economic lot size on the L scale. In the example shown on Fig. 3, a setup cost

of \$30.00, a monthly usage of 600 units and a unit cost of \$20.00 result in an economic lot size of 360 units.

As indicated, the nomogram of Fig. 3 represents a specific case. The 17 percent value is based on specified requirements for return on invested money, floor space and related charges, and process times averaged in the v figure. Since this nomogram would not fit all circumstances, a general nomogram can be constructed, Fig. 4. This nomogram covers combinations of k, m and v factors ranging from 0.05 to 0.30. In the example shown on the nomogram, k is assumed to be 0.10 and mv is taken to be 1.4 so the k (1 + mv) factor is 0.24, or 24 percent. Other values are the same as in the preceding example, but the economic lot size is found to be 300 units.

Input data: In actual practice, reasonable values for S, m and c are obtained only with difficulty unless the basic groundwork has already been done by the standards, sales or methods departments. At Barber-Colman, setup costs are obtained from the standards department for about 75 percent of the calculations. Proper values of S for the remaining calculations are obtained from an operation chart used in conjunction with a route card for the job.

Unit costs are also available from the standards department in about 75 percent of the instances. Data for the rest of the calculations must be determined after considering the operations involved. Values of m are found from a combination of sales department forecasts and historical data on repair part requirements. Past experience is used as a guide in setting usage figures, along with forecasts based on predicted general trends and specific influences on future orders.

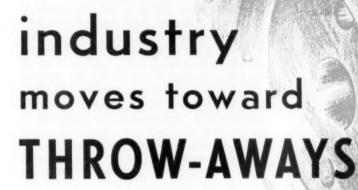
With reliable estimates for the factors involved and with assumptions based on the circumstances in particular plants, these nomograms, or ones prepared in the same way, can be used to easily determine economic manufacturing lot sizes. With such an approach, financial and production biases are avoided and the best interests of the company can be served.

Hose Selection Tips

Experience shows that particular care should be given to type of hose used in blast cleaning or shot peening activities, Engineers at Thermoid Co., Trenton, N. J. found that when sand is used for cleaning metal and other surfaces, the resultant abrasion is very hard on hose. Tube used in the operation should be composed of pure gum rubber

so that the sand particles will bounce off.

When metal shot is used, the greatest detriment is static electricity. A static wire will control this problem. If not controlled, the electricity will generate high-voltage potentials which will burn through the tube and wall. The tube should be compounded to conduct and dissipate electricity.



By R. W. Ruckel

President Wesson Co. Ferndale, Mich.

Based on a nation-wide survey of metalworking plants, this article analyzes the present status and the outlook for throw-away carbide tips. A strong trend is already apparent in turning applications; even greater use is forecast in milling.

Use of throw-away carbide tool inserts is growing rapidly throughout industry. Already virtually two-thirds of the companies engaged in metalworking activities are utilizing some single-point tools fitted with throw-away blades. Furthermore, in those companies, throw-aways at present represent about a quarter of all single-point tools. These studies indicate that three of four companies in metalworking are planning to increase their use of this kind of tooling.

Prime reasons for the rapid increase in use of throw-aways are the facts that they reduce machine down time through quicker tool changing and eliminate sharpening operations. Low initial cost of the blanks and tool cost savings per piece produced are cited as other, although apparently less important reasons.

In addition to the growing trend to throw-away carbide inserts for single-point tools, the survey uncovered some surprising data on application of such inserts to milling and other machining operations. About two out of every three companies heard from said they believe this type of tooling holds promise for milling cutters, Fig. 1. This indicates even greater interest in throw-aways for milling than for turning operations and is attributed to the greater difficulty of grinding multiple-point tools. In fact, 97 percent of the companies who like the idea of throw-aways for milling give the elimination of grinding as the big reason.

Considerable interest is also evidenced in applications of throw-aways to other forms of tooling such as boring tools, reamers and drills. As yet, few such tools have been available for sufficient lengths of time to provide a good base for evaluation. That they hold out promise, however, seems definite. Some 40 percent of industry agrees and over half of these companies have already tried throwaways in applications other than turning and milling. Chief uses have been in planing, shaping and boring, although some thirty or forty different categories of tool types have already been tried with throw-away tips.

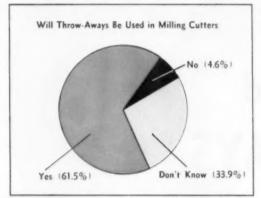


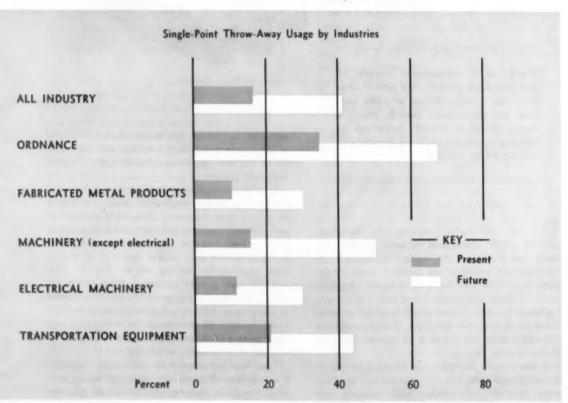
Fig. 1. Outlook for use of carbide throw-away inserts in milling is excellent since over 60 percent of companies queried registered a positive interest in this application.

Trends toward increasing use of throw-aways can be analyzed in greater detail when they are studied in terms of single industries, Fig. 2. Of the various metalworking industries, the ordnance industry shows the greatest current usage of these carbide tips as well as the greatest potential increase.

One of the country's largest metalworking industries is in the field of fabricated metal products. It comprises manufacturers of such items as tin cans, cutlery, heating and cooking apparatus (non-electric), screw machine products, etc. There are some 4000 plants with more than 20 workers in this category. Because of the nature of operations the average annual cutting tool purchase per plant is far below the all-industry average and the percentage of throw-aways used is smallest of any of the industries surveyed. The outlook for increased utilization is good, however. Over half the plants plan to use more; the increase will bring total applications of throw-aways in this industry to 30 percent of all single-point tool operations.

This industry also indicated less interest in carbide throw-aways for milling and other machining work. Only one plant in seven has tried such tips

Fig. 2. While over-all application of carbide throwaways for turning can be expected to reach 40 percent soon, ordnance production evinces the greatest interest in such tooling, manufacture of fabricated metal products the least.



for other than single-point work. Tools for turret lathes and planing were most frequently mentioned.

Machinery manufacture (except electrical) represents an industry covering a broad range of products including agricultural machinery, machine tools, industrial machinery, office machines, etc. It comprises some 4000 plants of over 20 employees. Size of the average machine shop, based on annual cutting tool purchase, is about double that of the average fabricated metal products plant. Following the over-all trend, better than two out of three are currently using throw-aways.

Smaller than the nonelectric machinery field, according to the number of plants (1500 with over 20 workers), but with a much higher tool consumption per plant, is the electrical machinery field. It includes such large-plant groups as manufacturers of electric appliances, radios, phonographs and similar equipment, electric motors, generators, etc. Impact of throw-aways in these plants is less than in the nonelectric machinery industry. A sizeable increase in usage is forecast, which, however, will still fall somewhat short of the all-industry average.

Transportation equipment includes the leader in the use of throw-aways to date—the automotive industry. It also covers manufacturers of bicycles, railroad equipment, boats and ships, etc. Roughly three-quarters of all these plants are using throw-aways and for these users such tips account for 29 percent of single-point operations. Most of the non-users, incidentally, are among the smaller companies. Projected use is expected to double shortly.

According to this analysis, correlating size of

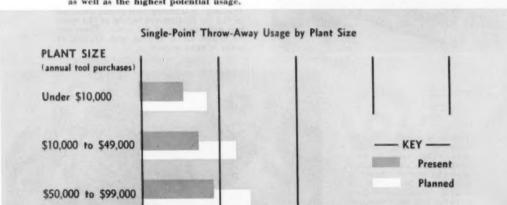
plant by volume of annual tool purchases, size of plant has little bearing on the proportion of throwaways used, Fig. 3. It appears, on the other hand, that plant size does have a definite relationship on whether the plant does or does not use throw-aways. So far, less than half of the smallest plants are using them while 85 percent of the largest plants are using them. Thus the larger the plant the more likely it is to be using throw-aways.

Similarly the data indicate that the larger plants are more likely to be planning to increase usage of throw-aways. The projected amount of increase also goes up with size of plant. When the projected increases are added to these figures found for present utilization, expected total use of throw-aways is 50 percent of all single-point tools in the larger plants, 40 percent in middle-size plants and 30

percent in the smallest.

Plants not using throw-aways were queried with regard to their reasons. Most frequently cited was "lack of personnel or time for analysis or application." Next was the impression that throw-aways were not too suitable for short runs. Many plants, of course, actually have no turning operations so they normally would have little reason for interest in tools of this nature.

"No need for them yet," was mentioned; "cost" rarely. Some companies said they were waiting to start using throw-aways until they tooled up for new products. A few with well-developed and well-equipped tool grinding departments hesitate to make changes that would tend to eliminate such departments.



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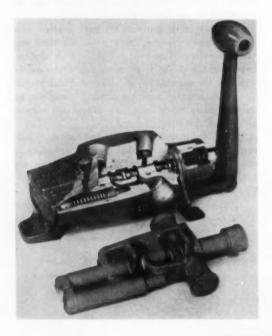
Fig. 3. Large industry reports the greatest application of throw-aways in turning as well as the highest potential usage.

\$100,000 and Over

Percent 0

designed for PRODUCTION

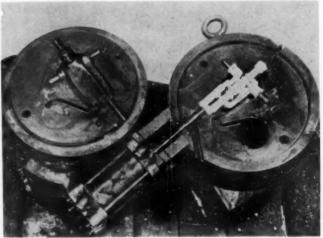
Zinc Core Melts Out of Die Casting



Production of a specially designed hydraulic valve was found to be impractical if standard coring techniques were used. With a process developed by the Char-Lynn Co., production of this valve became practical and greater freedom will be possible in internal design of die castings. Passageways and porting can be intricate but with smooth curves that promote laminar flow of hydraulic oil. Normal coring and drilling, on the other hand, result in square corners, which cause turbulence and heating of the oil.

ZINC CORE and a sectioned valve made with such a core. With this core it is possible to achieve blind holes, undercuts and other cast-in advantages not practical with standard die casting procedures. The only machining operations required on the die casting are boring of the spool hole and tapping of the ports. There are no drilled holes to plug and drilling of ports is unnecessary.

coring is accomplished by first die casting a zinc core. This core is then coated with an insulating material and positioned in the valve body die as shown. Aluminum is then injected into the closed die in the conventional manner. As the aluminum solidifies, the zinc core picks up heat and melts. This builds up pressure, which is released at a predetermined value by opening a die valve. The molten zinc then flows out of the valve body and is discharged from the die.



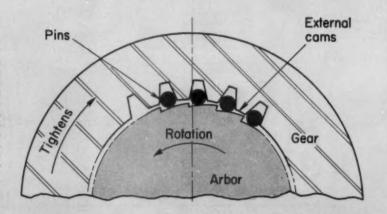
Pin Type Arbor Used Without Press

Specially designed for turning and grinding operations on internally splined blanks, locking pin arbors apply equal force around the splined bore to prevent play. The rigid grip of the arbor on the workpiece results in square and true faces and sides on the blank. Improved finished gears are produced because of this arbor, developed by Scully-Jones and Co., since pitch-line runout is avoided in subsequent cutting operations. These arbors are used without a press, and without nuts and wrenches.

GEAR BLANK is removed from the arbor after being turned to size. With these arbors, the pictured arbor press is superfluous since it is not used for either inserting or removing the arbor. Pins are carried in a sleeve that is free to rotate.



CLOCKWISE rotation of the gear blank on the arbor causes the pins to move outward on external cams on the arbor. At the same time, the pins are wedged into the involute apline. Rise of the cams is such that the pins remain locked until the blank is turned counterclockwise. Lock pins tend to tighten during turning and grinding operations.



AUTOMATIC LATHE Removes Weld Flash

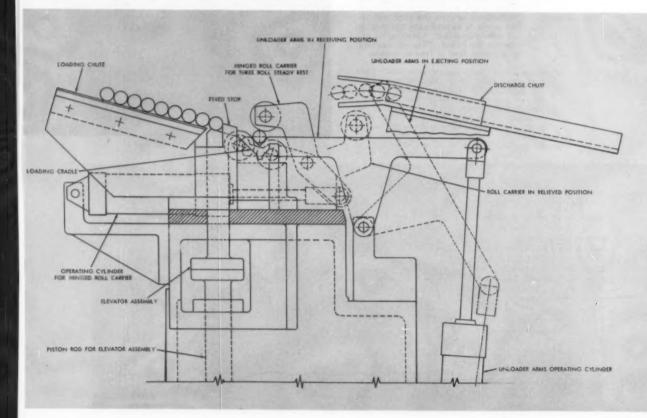
To solve the problem of removing a welding flash from a worm-shaft assembly on a high-production basis, an automatic lathe has been equipped with standard units. These include: a combined headstock and feed works unit, a headstock turner slide, and an automatic loader and ejector mechanism. This modification of a standard lathe by standard units resulted in a specialized machine

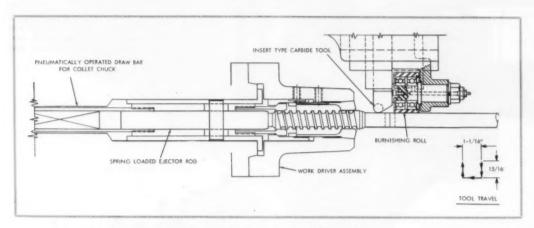
with low cost and short lead time.

Loading, machining and unloading are automatic in this Seneca Falls Model LN, however, push button controls are installed for the manual operation of each movement. The loading cycle cannot get out of time since the automatic sequence is controlled by a system in which each movement is initiated by the completion of the preceding movement.

WELDED PARTS are delivered to the lathe by a conveyor that joins the loading chute. The parts roll by gravity to a fixed stop, which is the loading position. On completion of a part, the spindle stops, the hinged steady rest roll carrier is retracted, the collet opens and the

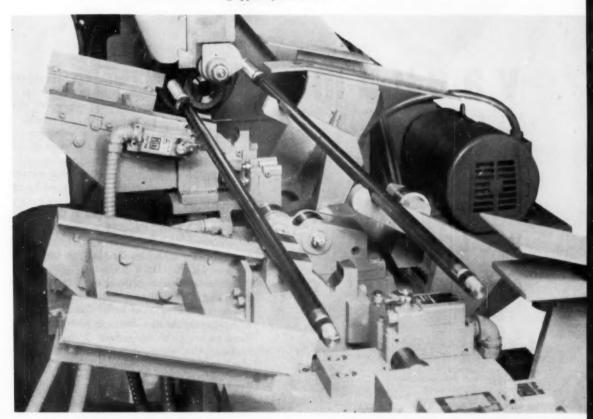
part is ejected from the collet by a springloaded rod. The part is deposited on the unloader arms, which immediately swing it into the discharge chute. An elevator raises the next rough piece over the stops and into the loading cradle, from which it is injected into the collet.

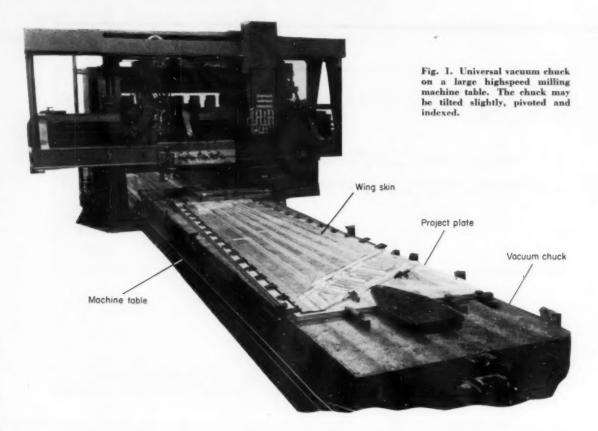




TOOLING for the modified lathe includes an insert type carbide tool to remove the hot flash and a burnishing roll to smooth and blend the junction of the welded parts. The workpiece is held and driven by a collet chuck.

FINISHED piece being ejected, at right, and a rough piece about to enter the loading cradle. The top roll of the steady rest automatically positions itself on the workpiece after the latter is gripped by the collet.





Vacuum chuck utilizes welded construction

By Alex A. Durand

Project Engineer Development, Research and Materials Engineering The Falk Corp. Milwaukee, Wis. HIGH-SPEED MILLING OPERATIONS on large aircraft panels require some means of holding the sheets or slabs firmly as they are reduced to relatively thin sections. This can be accomplished by creating a vacuum between the underside of the workpiece and its support. This is supplemented by clamps around the edge of the workpiece to assist in sealing off the vacuum. This arrangement is known as a vacuum chuck. Size of the operation is determined by the capacity of the milling machine. The chuck surface usually is of an area at least equal to that covered by the cutting heads. Chucks may comprise one or more sections, depending upon over-all size and the type of work required on the panel. A five-section chuck is shown in Fig. 2.

Portions of the skin or panel are often of varying thickness. The variation may be lengthwise, crosswise or a combination of both. Chuck support or mounting must be of a design to permit tilting the chuck to bring the top surface of the work into position. Also, where integral ribs or stiffeners are of a converging type, pivoting or indexing the work

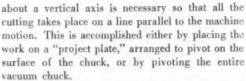
Based on a paper submitted in the recent Machine Design Competition sponsored by The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio.



Fig. 2 (above) Underside of five-section vacuum chuck fabricated by arc welding of formed plate sections.

Fig. 3. (right) Underside of vacuum chuck almost square in shape and requiring supports from the machine table only at the four corners.

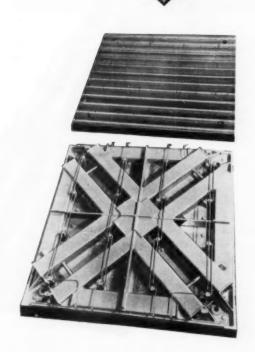
Fig. 4. (below) Chuck with diagonal reinforcements underneath the plate.



Certain basic requirements apply to all universal vacuum chucks, despite the fact that they are usually "custom tailored" to suit the job. In general, the following features are important.

Permanently Flat and Rigid Work Surface: Top surface should not vary more than 0.003 inch in flatness. Rigidity should be such as to permit finishes of 50 microinches on aluminum alloys. Deflection from cutting tool forces and loading should be low enough to permit milling skin thicknesses within 0.005-inch tolerance. Typical limit: 0.003 inch with 3000-lb load concentrated on a 2-square-foot area at the intersection of diagonals drawn from centers of the chuck support.

Few Supports: To hold setup time to a minimum supports underneath which require adjustment should be limited. Design details vary widely,



depending upon dimensions and reinforcements necessary. Figs 3 and 4 are designs with supports at each corner. Where length greatly exceeds width, intermediate supports are essential.

Minimum Weight: Materials should be able to hold a vacuum of 23-28-in. mercury without leakage. AISI C1020 steel meets these qualifications, in addition to having good formability, weldability, plus moderate cost. Chuck in Fig. 3 averages 100 lb per square foot; chuck in Fig. 4, about 146 lb per square foot.

Minimum Vertical Displacement: This allows maximum tilting to be secured in the machine. Vertical displacement will vary from 4 to 24 inches, according to degree of longitudinal and transverse tilt desired. Normal size (10 x 25 foot) single-section universal chucks currently are designed to tilt 2 deg longitudinally, 5 deg transversely, and to index 3 to 15 deg.

Flexibility of design with maximum economy has dictated the use of welded steel plate fabrication for large universal vacuum chucks. A typical chuck, Fig. 5, comprises a top surface of three plates, one at the center 2% inches thick and the other two 1¾

inches thick. Plain transverse ribs are 3/8-in. plate. The underside in the area around the center is 3/4-inch plate, while the periphery includes sides and end plates 13/4-inch thickness, into which T-slots are machined.

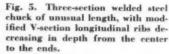
Depth of the V type rib varies; the deepest ones are near the chuck center and decrease in depth toward the ends in order to obtain a section of uniform stress. From these wide variations in thicknesses and shapes, it can be readily understood why welded fabrication is the only practical and economical method of construction.

Fabricated chucks offer unlimited possibilities for built-in accessories. One chuck, Fig. 4, incorporates a vacuum tank which is actually the space enclosed by the eight diagonal U-shaped stiffeners. Also built in are two headers, one on each side, for air and vacuum supply respectively. Vacuum ports and air-actuated work-lifting cylinder are piped to these headers and are controlled by shutoff cocks.

Another design, Fig. 5, features a clamping system using cables controlled by two pneumatic cylinders. Cable guides are shaped tubes and plates built into the chuck. The cylinders nest neatly between longitudinal stiffeners and are protected from external damage.

It is estimated that a fabricated vacuum chuck will be lower in cost than comparable cast designs by amounts ranging from \$5 to \$20 per square foot, depending upon type, size and quantity to be built. Finishing allowances on weldments also are less. A 100-square-foot section, Fig. 4, had only 3/s-inch finishing stock allowance on the top, against a probable 5/s to 3/s-inch on a cast plate.

These are but a few of the savings that are possible by using welded construction in the design of vacuum chucks. Not only will construction time of the chucks be reduced, but over-all versatility and flexibility will result, allowing the chuck to hold the workpiece so that the over-all accuracy needed in the machining operation is obtained.



Engineering Small-Plant Automation

By William C. Goeckel

Snyder Tool and Engineering Co. Detroit, Mich.

Many reasons are given to explain why small plants have lagged in developing automation suited to its special needs. In this article, based on a presentation at the 1956 Iowa State-ASTE On-Campus Conference, an executive of a well-known builder of automated machine tools offers some unusual—and practical—auggestions for overcoming this inertia.

Length of production runs, rather than the number of employees, is the best basis for evaluating the possible application of automation in a plant. Many small plants produce large quantities of standardized parts. In such cases, it is economically feasible to use so-called "Detroit automation," with fully automatic machine loading and unloading and automatic transfer of parts from operation.

Production of other small plants, on the other hand, may consist of a wide variety of parts, manufactured in relatively small lots. Full-scale automation is out of the question. Most small plants fall into this category.

The in-line type transfer machine, Fig. 1, which has become the generally accepted standard by the

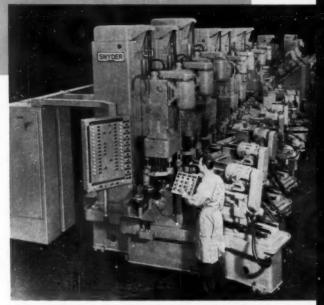
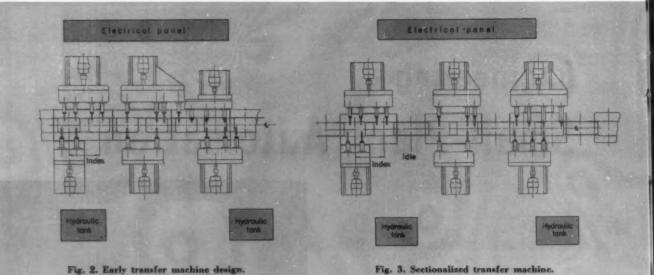


Fig. 1. Typical transfer machine with 75 stations produces 144 transmission cast-iron pump bodies per hour. Provision is made for in-process gaging and sectional operation to reduce down time.

automotive industry, is in reality a series of special machines in which transfer bars move parts from one machine segment to the next. It is designed strictly for high production of a particular part during a given model run. One operator merely loads parts into the machine at one end and they come out finish-machined at the other.

It may take from two to three days to change over such a machine to accommodate a design change, even if the part difference is only a matter of a few more holes, a longer center distance or a few diameter changes. Cutting tools, fixture details, head speed and head travel all must be adjusted in the change-over. Experience has shown that about four hours is required to set up each segment in which an alteration is required, providing the necessary equipment and tools are available.

Unless a small plant is in the high production



category, time and cost of setup changes practically

type of transfer machine. Another type of semiautomated production line is practical for a small plant making a variety of related parts. This line consists of a series of simplified special machine tools. Each machine is loaded and un-loaded manually and an operator handles two or more machines. Each machine is designed to perform several operations

eliminate the possibility of economic use of this

during its operating cycle.

Assume that this semiautomated line consists of a combination milling machine, a combination drilling machine, a combination tapping machine and a combination boring machine. Four related parts each have a few tapped holes, milled faces or bored holes are to be produced on this line. With these predetermined requirements, machines can be built to produce these four parts with a maximum change-over time of about eight hours. They will work around present tooling and minimize change-over time by banking between machines. Thus, the small manufacturer can make economic use of a line of machines embodying combination operations and automation concepts.

Cost Considerations

First cost of an in-line transfer machine may be the determining factor as to whether the small manufacturer in high production operations can afford it. He, too, may economize in the long run by buying a semiautomatic line of special machine tools.

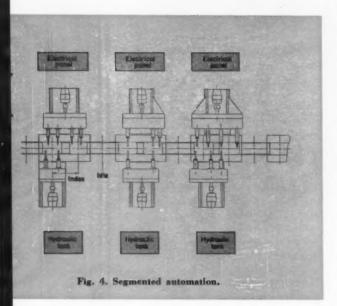
Several factors contribute to the higher initial investment required for transfer machines. These added costs cannot be economically justified unless they are offset either by substantial labor savings or scrap elimination. Most of the added first cost in the transfer machine comes from the transfer mechanism and the controls that sequence the various segments. Often the parts must be turned over or reoriented during processing and such mechanisms are both complex and expensive.

Most manufacturers today are conscious of the high cost of transfer machine down time. This has meant that in-process gaging and part reject devices are added requirement for peak operating efficiency of transfer machines. Engineering costs for transfer machines are also considerably higher than with a simplified special line.

Development of Transfer Machines

Tremendous strides, however, have been made in the past few years in improving basic designs of transfer machines so that they are more flexible and easier to change over.

The drawing, Fig. 2, represents the first concept of transfer machine design. The bases of the individual machining units were bolted together. Heads reached out over split lines. As a result, poor access was provided for tool change or head and fixture maintenance. One large and complicated control panel housed all machine controls, which made trouble shooting a complex operation. Hydraulic power units ran more than one machining unit, thereby increasing down time problems in case of a power unit failure. If one machining unit had to be shut down for tool change, the entire machine had to be shut down and there was no possibility of keeping other units or groups of units in operation. To avoid these problems of maintenance, an im-



proved design was evolved by builders and users.

This next sketch, Fig. 3, represents sectionalized transfer machine design. Shown in this drawing is one section of a transfer machine. It has its own control panel, the bolted base design has been eliminated and the machining units are spread apart to simplify maintenance. Means are provided to feed parts manually into the transfer line ahead of the next section, thus permitting other sections to operate from stock banks when one is shut down for maintenance.

One of the next steps in the design of transfer machines is segmented automation, Fig. 4. This transfer machine is in reality merely a series of individually controlled machining units, each with its own control panel and hydraulic power unit. Only a transfer bar connects the units. Sequencing of the unit operation is achieved by controls in a separate main panel.

This machine is easy to maintain and tool changes can be made with minimum effort. Workpieces can be fed into the machine at any point when other units are shut down for maintenance. If the user wants to change the design of the part for the next model, the line can be spread and other units inserted. If a unit needs reworking, it can be pulled out of the line and new details added at change-over time.

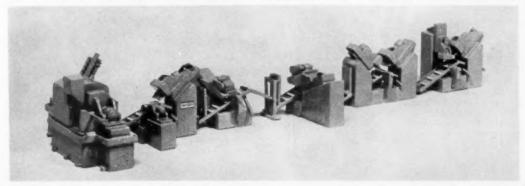
What may be the in-line transfer machine of the future is shown in Fig. 5. Two of these are already in operation, producing rocker arm shafts at a rate of about 200 pieces per hour at 80 percent efficiency. This 8-station machine further extends segmentation concepts. Actually it comprises six individual machines. Instead of a conventional transfer bar mechanism, the transfer device raises parts up an inclined plane by a pusher bar. Parts fall by gravity to an escapement. At this point, parts can be fed manually or stacked vertically for intermachine storage. From the escapement, the parts are moved up another inclined chute where they fed to the next machine.

The first unit is a trunnion index machine from which spotfaced and counterbored parts are automatically unloaded and placed in the transfer mechanism. Replace the transfer mechanism with conveyors and it would be difficult to distinguish this line from a prewar automotive line. Remove the transfer mechanisms completely and the result is a line of simplified special machine tools exactly like those discussed for small-plant automation. Thus, present ideas about transfer machine design are closely allied to the semiautomatic line of special machines.

Typical Small Plant Installations

These simplified special machines can be of greatest benefit to small plants producing a variety of parts in relatively small lots. One example of a suitable machine for such applications is a twoway precision boring machine on which nineteen

Fig. 5. Sketch of advanced type of transfer machine utilizing inclined chute to convey parts between operations.



different semi-mass produced parts are processed, Fig. 6.

The machine produces one cast-iron power takeoff transmission case every 50 seconds. Two fixtures enable the boring of up to four holes at each fixture location. Each two-spindle boring head is a separate slide unit that can be operated manually, automatically or in combination with other heads in an automatic machine cycle.

Thus, maximum flexibility of operation for parts in small-quantity production is provided. Beltchanging devices allow quick spindle-speed changes for various bore sizes. Magnetic chucks in the workholding fixtures give maximum work-holding flexibility and avoid the necessity of clamping details. Fixture heights are adjusted with quick-change spacers. Gage blocks are used to adjust the various parts to correct lateral location. Micrometer stops provide depth control for each head. The boring heads have index pins that allow quick adjustment of hole center-line angular location. Center-to-center distance of the spindles is adjusted with spacers.

Cooperation between Machine Builder and User

Machine tool builders are faced with many problems in preparing a design proposal for an automated machine tool. From one to four weeks are required for preliminary design and engineering work. If both a transfer machine and a simplified special machine are proposed for processing of a variety of parts, it may take one to two months to do the job right.

Of course, making such proposals can be an expensive procedure for the machine tool builder. Unless he knows and understands the company for whom he is doing the work, he is reluctant to go to a great expense with no assurance of building the machine. This is particularly true in the proposal of automated machine tools for small industry, where machinery must be fully amortized over a short period of time.

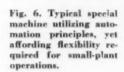
When a proposal is submitted to such a small firm, it is generally brief and sketchy. In most instances the machine tool quotation must include all possible contingencies. Obviously it is impossible for the builder to turn out large numbers of engineered quotations for small plants on a speculative basis.

If the machine tool industry is to assist small industry in staying in the competitive market with large industry, another way of proposing automated machine tools for small industry must be found. A possible solution to this problem may be for plants with low production requirements to seek out a single machine tool firm who they believe has the ability to assist them in engineering for their automation problems.

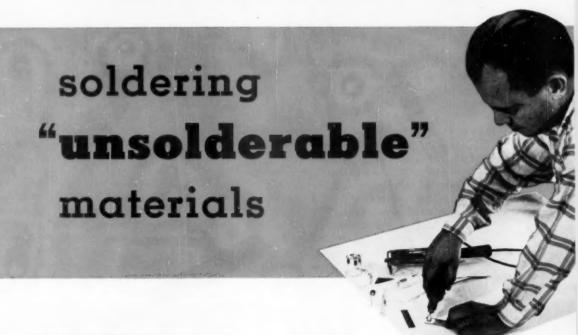
The small manufacturer can enter into a cooperative engineering program to develop and work out the machine tool that best fulfills his particular production requirements within the budget. The cost of such a cooperative engineering program would be shared by both the machine tool builder and user. Thus, a suitable design could be worked out that could be submitted to the user's top management with reasonable assurance of receiving a goahead.

Admittedly, a cooperative engineering program would eliminate competitive bids. However, since machine tool builders working with small industry are compelled to follow a sketchy "safe-cost" proposal method, it is doubtful if the present system has much real value in terms of the best machine at lowest cost.

A cooperative engineering program is probably the only way that small industry can achieve the full advantages of automation. Automation simply requires more time to engineer and develop than a machine builder or a small manufacturer can afford to invest alone.







By Joseph C. McGuire Los Alamos Scientific Laboratory* Los Alamos, New Mexico

dissimilar materials heretofore considered unsolderable.

Fig. 1. New soldering technique permits joining of

Soldering dissimilar materials, such as aluminum to stainless steel or glass to aluminum, has always been a problem to tool engineers. The cost of the special equipment required may be prohibitive, particularly when only a few assemblies are to be produced.

An unusual technique which permits soldering such materials, Fig. 1, has been developed by the University of California's Los Alamos Scientific Laboratory. This method is expected to effect substantial savings over the special machine and ultrasonic methods now being used. The technique was discovered during a research project on the use of ultra-high-frequency sound waves in soldering, and ironically involves something that apprentice mechanics are taught not to do—"load" the abrasive wheel.

In addition to the usual soldering materials, only a hand grinder with an abrasive wheel and a stick of low-melting alloy are required. Two types of grinders have been used: the standard Handy-Grinder and the Dumore Grinder with fixed motor and flexible shaft. The Handy-Grinder is operated at slightly reduced speed from a Variac at 80 to 100 volts. It is low powered but reaches high speeds if allowed to run free. The Dumore is higher powered

and lower in speed, but more difficult to use in a confined space. However, most grinders in this class would fit the bill.

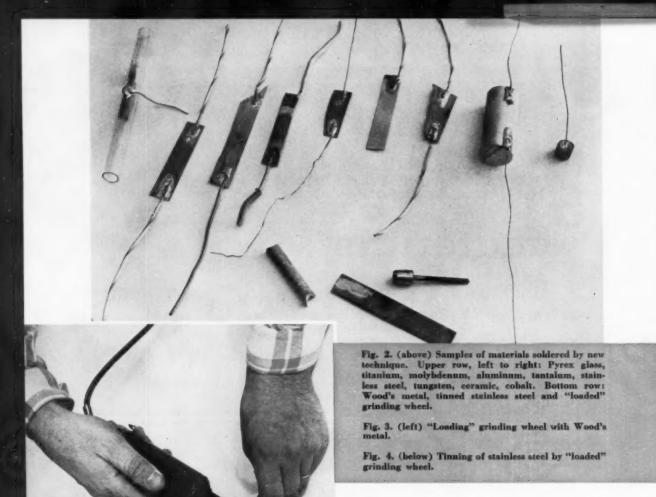
A satisfactory grinding wheel has been found to be of a medium grit, ½-inch diameter by ½ inch long, although wheel type and size are not critical.

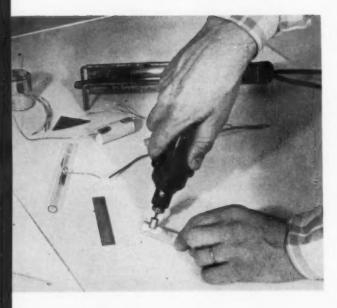
To solder these previously unsolderable materials, Fig. 2, the grinder is turned on and the abrasive wheel, preferably preheated by bringing it in contact with metal or by the direct application of heat, is brought to bear on a soft solder such as Wood's metal or 60-40 lead-tin. This tinning alloy is applied to the wheel in bar form, Fig. 3. The warm grinder head and the heat generated by the wheel's contact with the alloy will produce a liquid film of metal. This film of soft solder flows onto the surface of the wheel, "loading" it and incidentally making it useless for its customary purpose until it has been trimmed down. Repeating the process two or three times builds up a fairly heavy coat of tinning alloy. There is a definite "conditioning" period for a new grinding wheel, and this is determined only by experimentation. Once a good deposit is built up, it is very easy to renew the layer after each tinning use.

After forming a substantial deposit, the solderloaded wheel is applied to the work with about the same pressure used in normal operation of a hand grinder. If possible, the workpiece should be warmed, preferably to the melting temperature of

^{*}Operated by the University of California for the Atomic Commission.

This process was first described in the Review of Scientific Instruments, Vol. 26, No. 9, page 893, September, 1955.





the tinning alloy (about 80 C), before applying the wheel to the workpiece. This is true particularly when the operator is just becoming accustomed to the process. Bringing the workpiece to the temperature of the tinning alloy can be accomplished by the application of a hot soldering iron to the area adjacent to the place where the joint is to be made. When working with such materials as soft glass, Pyrex and ceramics, it becomes necessary to use flame or furnace heating to get enough heat to the surfaces to be joined.

When the correct workpiece temperature is reached the solder-loaded wheel is applied to the surface to be soldered, Fig. 4. The abrasive action of the wheel generates heat and again melts the solder, which flows onto the abraded surface and forms an intimate contact. The tinning layer is laid down as a shiny spot or strip. Little ridges of excess alloy follow the wheel as it moves across the area. Correct pressure of the wheel on the workpiece will be gained if one bears in mind that he is removing the oxide layer of the material and replacing it with solder.

The two surfaces to be joined need not be of the same material. However, after preparing one surface, the other surface should also be treated if it is a material not ordinarily "wetted" by solder.

After one or both surfaces have been tinned, soldering the two parts together, Fig. 5, is done in the usual manner with standard 50-50 lead-tin solder. No soldering flux, surface cleaning or pre-treatment is necessary.

The solder is applied to the tinned surface with a soldering iron, keeping the hot iron from touching the subsurface layer of the base material. In other words, either heat the joint by applying the hot iron to some adjacent part of the metal which is not tinned and then apply the solder in wire form directly to the tinned surface; or apply the solder to the iron and bring the hot drop of solder down to the tinned area, still refraining from making contact with the base metal. This is particularly important when soldering titanium, niobium and tantalum, Fig. 6.

Many low-melting alloys ranging from 40 to 140 deg C seem to work well in this tinning operation. Some of the more successful include Wood's metal, Rose's metal, 50-50 tin-indium and 50-50 lead-indium. The 50-50 tin-indium may be applied very easily to Pyrex glass without the usual degreasing and heating cycles and, once applied, will take a higher melting solder for a surprisingly firm joint.

Ordinary solders cannot be used for tinning operation on glass and ceramic materials. Wood's metal plus 50-50 indium-tin has been found best for this application, with ordinary solder being used for the actual soldering. Failure to deposit a satisfactory coating with Wood's metal on glass indi-

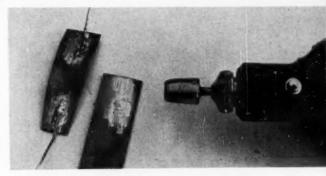
Fig. 5. (below) Soldering of copper wires to previously tinned ceramic.

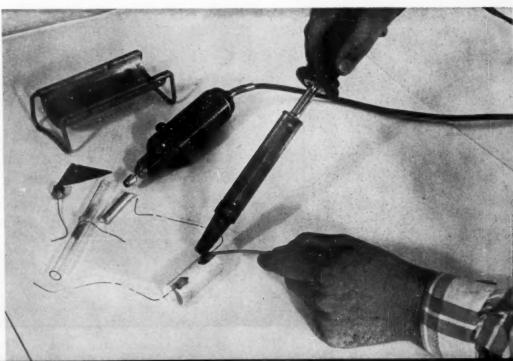
Fig. 6. (right) Close-up of copper wries soldered to tantalum, tinned stainless steel and "loaded" grinding wheel.

cates that the wheel was too cold when initially loaded or was not completely loaded with Wood's metal. Also, if the rotation speed of the grinder is too fast, the Wood's metal will be laid down as a black deposit on the glass and the solder will not adhere. The speed of rotation should be reduced until a shiny coating can be deposited. A black deposit will also appear if there is grease or oil on the glass.

One point to remember is that a soldering iron will not supply enough heat through a poor conductor, such as glass or ceramics, to make a good glass-to-glass joint in large or thick pieces. This technique is best suited for fastening electrical connections and similar light work.

This unusual technique is still in the experimental stage and is used to a limited degree as it takes time to master the little things, such as the appearance of a properly tinned surface or proper application of the solder. However, as operational data is gained, increased numbers of application can be foreseen in the aircraft, electronics and laboratory equipment industries.





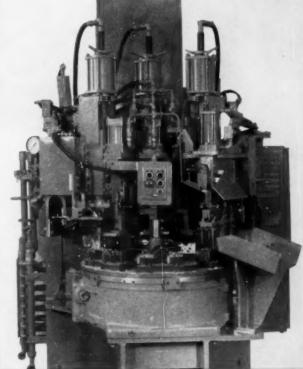


DIE FINISHING is speeded by a special die tryout bench which simplifies corrections being made on punch at A. C. Gilbert Co. In a subsequent step (close-up) tryout time is cut in a new technique permitting pulling a pattern merely by tilting the top plate to horizontal position and lowering the punch over the die. Adaptation of the Hamilton "Portelevator" by design of the special tilting mechanism has released a hydraulic press for other work, as well as drastically reducing man-hours formerly required for finishing and tryout in the tool and die department at Gilbert.

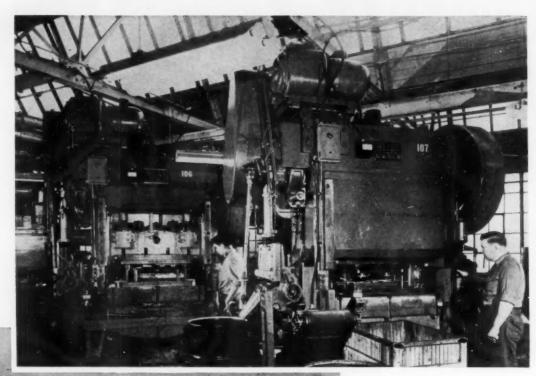


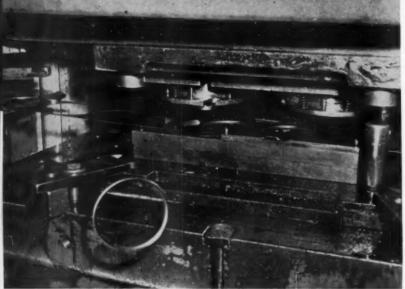


HOT HEADING is utilized in a high-production assembly operation to fasten door lock cover cup to lock base plate after lock gear is in place. Parts are loaded manually. Special dual-ram Taylor resistance welder (right) heats ends of cup tabs and upsets them. Finished assemblies are unloaded automatically. By use of a pair of dies at each station two assemblies are processed simultaneously. Tooling includes work locating guide pins for faster, more positive loading and positioning with minimum operator effort. Alternate die tables are readily interchanged for production of opposite hand assemblies. The six-station dial feed index table gives infinite adjustment of operating speed. Operation on machine at lower left is cold staking of same assembly.

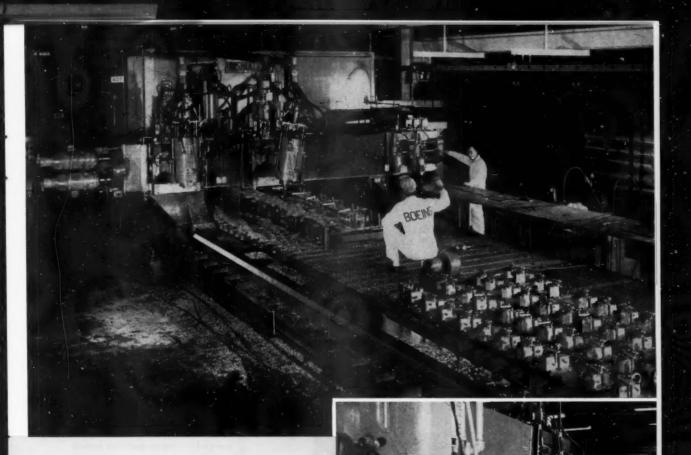


TOOLS at work



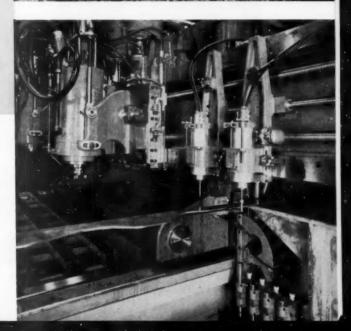


STANDARDIZING TOOLING for quick setups on high production presses has boosted short and medium run production of heater fans and similar parts from 50 to 100 percent at Torrington Manufacturing Co., Torrington, Conn. Setup is achieved in 1/2 to 1 hour on runs that often last only 15 to 20 minutes. More than 50 such parts are stamped out on these two Bliss machines equipped with double roll feeds and crankshaft-mounted friction clutches which require no adjustments. (Close-up) Steel front ring of heater fan is blown from two-station die into tote box. Part is cold rolled, temper 5 steel, and operating speed is 75 spm.



ELECTRONIC TRACER CONTROL SYSTEM directs profile milling operation on wing chord at Boeing Wichita plant. The cutting tool is guided over the workpiece by tracer head at right which automatically follows contours of the master template and controls speed of the feed drive. The G-E tracer control system includes six one-dimension tracers which control three motions on each of two heads simultaneously. Rise and fall and twist motions use selsyn-type tracers which reduce machine complexity and simplify templates required. Repeat cuts are made to accuracy of 0.002 inches at rates as high as 30 ipm.

TOOLS at work

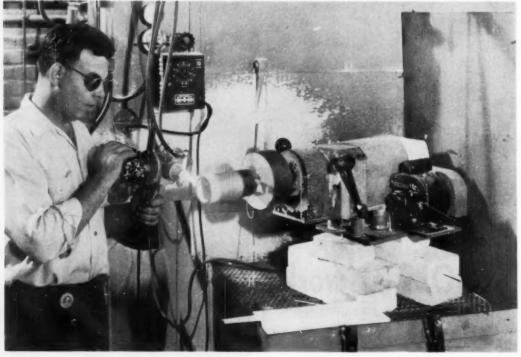




TOOLS at work

OPTICAL JIG BORER steps up production of precision control parts for small gas turbine engines at G-E Small Aircraft Engine Dept., Lynn, Mass. After desired length between points where holes are to be drilled is determined, the Linder machine's optical measuring system takes over, assuring spacings to accuracy of 0.00005 inch, reflecting measurements on a screen by means of a photoelectric indicator.

SPRAYING OXIDE COATING on experimental part at Norton Co. demonstrates ease of application. These "Rokide" coatings are being developed for use on parts for rockets and jet propulsion to protect against effects of high temperature, abrasion, erosion, corrosion and for electrical insulation.



how to machine plastics

part one plastics characteristics and sawing

By Robert A. Wason

Associate Editor

Although the words "overheating" and "gumming" cover most of the troubles encountered when machining plastics, these troubles are merely limiting conditions. There is room for much intelligent tool engineering in the successful application of machines, tools and processes. It is the purpose of this article to go beyond the cliche that "standard woodworking and metalworking tools and techniques are satisfactory."

W HEN IN DOUBT as to the correct machining techniques to use with a particular plastic, trial-anderror can give the answer. A reasonable starting point is to set up the job as if it were copper or brass. A few practice cuts will indicate the changes necessary in tool geometry, feeds and speeds for better results. It is, of course, better to know the correct cutting conditions for each type of plastic.

In order to understand the machining of plastics, it is necessary to first understand the characteristics of plastics. Basically, plastics are of two distinct types: thermosetting, which undergo chemical reactions, usually in the presence of heat, and are thenceforth relatively infusible; and thermoplastic, which soften when heated and harden when cooled.

Although thermosetting plastics can be machined, Fig. 1, with less attention to heat build-up than thermoplastics, all plastics are poor heat conductors and introduce heat problems. Poor tool design leads to friction, and friction leads to heat. Since the workpiece cannot conduct the heat away, heat must localize in the tool. This leads to short tool life and eventual gumming or burning of the plastic. The use of abrasive fillers in various plastic formulations compounds the problems of heat build-up and tool wear. Coolants or lubricants can reduce these problems but, unless chemical interactions and part cleaning difficulties are considered, can introduce

It would be hopeless to try to include all plastics in this article because new plastics and new families of plastics are being introduced rapidly. Techniques and equipment used to machine the established plastics will be included, along with information on the properties of these plastics. By noting similarities among the properties of new plastics and those established ones presented here, and by taking into account their differences, starting points for machining plastics that have yet to be developed can be intelligently arrived at.

The economics of machining plastics are not hard to understand. If parts cannot be molded or cast to required shape or tolerance, or if production runs do not warrant the expense of dies, machining is an economical process. Frequently, cast and molded

parts require machining for their completion. In any event, sufficient machining of plastics is done so that the metalworking industry is no longer solely involved with the working of metals.

Plastics Characteristics

Acrylic resins have working qualities similar to copper and brass, and can be sawed, punched, stamped, drilled, threaded, routed and generally machined. They contain no fillers or plasticizers that can dull or gum tools. In general, working edges for acrylic-machining tools require no rake and should scrape rather than cut. Tools for acrylics, and all plastics, should be kept sharp, free of nicks and burrs, and clean to prevent chipping and



Fig. 1. (above) Laminated Plastics can be sawed or milled with ease if carbide tips are used on the rotating

Fig. 2. (right) Alloy steel circular saw used to make straight cuts in acrylics. minimize frictional heat. Excessive heat usually results in gumming or tearing of the part, or sticking of the tool.

Acrylics parts and sheets can be machined at reasonable speeds without coolants. When coolants are needed, water or soluble oils should be used. Others may react with the plastic or the adhesive of the masking paper, which may be retained during some operations. Feed should be moderate but continuous. Tools should not be stopped during a cut because this results in a visible mark.

Acrylic parts can be machined to tolerances of ± 0.001 inch. To maintain close tolerances, it is necessary to anneal at the time of machining and inspect parts at specified temperature and humidity. Since the coefficient of thermal expansion is 0.000042 inch per inch per deg Fahr., temperature levels and variations are important to accuracy. When much material is to be removed, several annealing steps may be required to prevent machining stress build-up.

In general, polystyrenes are difficult to work. However, if proper precautions are observed, polystyrene parts can be machined by all the conventional processes. Temperatures over 140 F, or higher, depending on the type of plastic, will result in crazing and gumming. Crazing cracks are not only unsightly but they also lead to failure in use. A coolant is necessary during the machining of polystyrene parts. An air jet is best because it removes chips effectively at the same time it cools. The best liquid coolants are 100 percent paraffin oils. These adhere and flow well but are difficult to remove. Another coolant consists of 10 parts water to one part of 40 percent sodium silicate. Soapy water and completely aliphatic soluble oils are also used with success. Powdered zinc stearate can be used as a lubricant on difficult jobs. Common cutting oils or kerosene should never be used because

Photo courtesy Cadillac Plastic Co.



machining plastics

they promote crazing and cracking. For especially rigorous short runs, a can of dry ice in the coolant reservoir can reduce temperatures. Refrigeration equipment can be used for long runs.

Polystyrene should not be overclamped and holding devices should be cooled when they tend to retain heat. When heat can be satisfactorily controlled, high-speed operations should be used to minimize the time the part is in the machine. Low speeds lead to tearing, dulling of tools, poor finish, gumming and poor tolerances.

High-speed steel, hard-alloy, carbide and diamond tools can be used, depending on the length of the production run. Tool geometry should give minimum contact and should provide for rapid removal of chips to minimize friction. Tools with positive rakes and hooks do not remove chips readily. Chips tend to coil around the warm tool and, regardless of coolant, soften and pile up back of the cutting edge. Cross-linked polystyrene tends to chip when machined. Tools should be eased into the work with light feeds. After the tool has taken a full cut, feed can be increased for maximum productivity.

High-impact polystyrenes have much higher elongation and can be machined with less chance for damage through cracking. Annealing can be used to advantage after machining with all types of polystyrenes. Because plastics are poor heat conductors, time for a complete anneal may be as long as 24 hours. Annealing at about 10 deg Fahr. beneath the practical heat distortion temperature is safe and achieves the desired stress relief.

Nylon resin parts can be machined easily to close tolerances with standard equipment. Nylon is free cutting and heavy feeds in combination with surface speeds of 500 to 700 sfpm should be used. Feeds can be reduced for better finishes. Heat must be minimized by tool design and coolants because the coefficient of thermal expansion is many times that of steel. Part size should be checked only at room temperature. All of the nylons are rather flexible. Provision must be made to prevent flexing of stock away from the cutting tool. Vibration and chatter should be avoided. When coolants are required, hydrocarbons or soap solutions are satisfactory. Refrigeration of the coolant can help to lengthen tool life and to meet close tolerances.

Improved dimensional stability can frequently be obtained by boiling rough-machined nylon pieces in water. Since nylon is hygroscopic and will pick up moisture, it is thus possible to achieve a moisture content equal to that it will have in service. Boiling increases the speed of pickup to about 250 times more than that at room temperature. With the correct amount of moisture in the piece, it can be finish machined. This is seldom necessary be-

cause nylon is resilient and tolerances do not usually have to be close.

Heat treating for stress relief of nylon should be carried out away from air, preferably by immersion in a liquid. Temperature should be higher than that in which the part will be used but should not exceed 400 F. Parts should be cooled slowly out of the bath and out of drafts. Drafts will reintroduce surface stresses. Experimental parts can be immersed in boiling water for heat treating. Since they absorb moisture, the parts should be weighed before boiling, then dried in an oven at 160 F until they return to original weight.

Parts made of rigid vinyl plastics can be machined, cut, ground, drilled and sawed. They can also be turned, faced, bored and threaded. Rate of heat development in these thermoplastics depends on tool design and sharpness, feeds, cutting speeds and clearances. Production runs should be set up only after trial since the highest cutting speeds possible without overheating are desirable. Allowable

Table 1—Major Types of Laminated Plastics

NEMA Grade	Laminate Base	Laminate Resin	Maximum Punc Cold (inch)	hing Thickness Hot* (inch)	
X	Kraft	Phenolic		1/8	
P	Paper	Phenolic	1/32	1/8	
PC	Paper	Phenolic	1/8		
XX	Paper	Phenolic		-	
XXP	Paper	Phenolic	1/32	1/8	
XXX	Paper	Phenolic	1/32	1/8	
XXXP	Paper	Phenolic	1/32	1/8	
С	Coarse Fabric	Phenolic	1/32	1/8	
MC	Coarse Fabric	Melamine	-		
CE	Coarse Fabric	Phenolic	1/32	1/8	
L	Fine Fabric	Phenolic	1/32	3/16	
ML	Fine Fabric	Phenolic		_	
LE	Fine Fabric	Phenolic	1/32	3/32	
Α	Asbestos Paper	Phenolic	Management .	1/16	
AA	Asbestos Paper	Phenolic		1/16	
G-1	Staple Glass Cloth	Phenolic	_	1/16	
G-3	Continuous Glass Cloth	Phenolic	-	1/16	
G-5	Continuous Glass Cloth	Melamine		1/16	
G-8	Glass Mat	Melamine			
N-1	Nylon		_		
	Cloth	Phenolic			
G-6	Staple Glass Cloth	Silicone —		1/16	
G-7	Continuous Glass Cloth	Silicone	_	1/16	

^{* 125} to 140 C

speeds can be increased with use of soapy or clear water, or compressed air. Chips from vinyl parts are generally slightly plastic and may tend to curl around drills or fill in clearances on milling cutters. Coolants or air blasts can prevent these conditions.

Polyethylene plastics are poor conductors of heat but can be machined if any of the common coolants are used. Usual practices of machining plastics and the special tool geometry considerations associated with machining plastics are applicable to the fluorocarbons. Polytetrafluorethylene, however, undergoes a crystalline transition at about 68 F and its volume changes about 1.5 percent at this transition.

Table 2—Alloy Steel Circular Saw Blades (used with acrylics)

Thickness to be Cut (inches)		Blade Thickness (inch)			Teeth per (No.)		Inch Blade Type			
		0.080	1/16		3/32 1/8	8	to	14		ground ground
		0.375 0.750	3/32	to 1/8	1/8	5	to to	6	Spring Spring	set set or swaged
1.000	to	4.000	1/8	to	5/32	3	to	3.5	Spring and ca	set, swaged

This transition must be considered when inspecting such parts.

A new group of plastics, foams, are becoming important. Frequently, they are foamed in place and no machining is required, but most of them can be machined. Expanded cellulose acetate, for example, can be easily machined to close tolerances with ordinary woodworking tools. Strengths of these foamed parts are maintained even though the skin surface is removed. Expanded polystyrene foam can also be machined. It is desirable to operate the saw or cutter at high speed, using slow feed and many small cuts.

Machinability of phenolic moldings reinforced with glass fibers is poor when compared to that for general-purpose phenolic moldings. When drilling, tapping or turning, for example, only about half as much production can be turned out between sharpenings of the tools. It is difficult to obtain clean cuts because the fibers tend to drag and leave a fuzzy surface. Machining of filled phenolics removes the lustrous surface which cannot be restored. Machining results depend to a large extent on the fillers. In order of best machining, fillers rank: wood flour, good; fabric, fair; cotton, fair; and mineral poor. High-speed steel tools can be used for small quantities, but carbides should be used for long runs. Lubricants can be used, but usually result in tough cleaning problems. Air blasts can be used effectively.

Phenolic casting resins are usually unfilled and

can be machined easily. High speeds and light cuts on standard machines are best. Special tool grades are unnecessary except for long production runs. Overheating of this thermosetting material can lead to localized weakness and should be avoided.

Laminated plastics, materials in which thermosetting resins are used with layers of nonplastic materials, require special consideration. Their mechanical structure is responsible for most of the differences that exist in machining methods. "Reinforced" plastics are actually low-pressure laminates but the distinction is gradually disappearing and will be ignored here. Macerated plastic moldings, in which the reinforcing materials are ground rather than layered, can usually be machined more easily than laminates of the same materials but frequently introduce more tool wear.

Laminated plastics have lower shearing strength than metals and can be cut at higher speeds and feeds. Because of greater resiliency, greater clearances and less rake are required. Machining operations are done differently at right angles to laminations than when parallel with laminations to prevent delamination.

For most operations, high-speed steel tools can be used, but carbides, and in some instances diamonds, prove more economical. Surface speeds can be doubled with carbides to: 600-1000 sfpm for ureas and melamines, Table 1, and 100 sfpm for phenolics. Machining is usually done dry because most liquid coolants are difficult to remove from finished parts. Although each combination of materials has different characteristics, workpiece temperature should be kept below 150 F as a general rule.

It is especially poor engineering to try to hold tolerances closer than needed on laminated plastics. Minimum tolerance spread for a ½ inch thick laminate is about 0.002 inch. Greater spread is much better. Thermal expansion is considerable and resiliency is up to 40 times that of steel. Because of "spring-back," cutting tools cannot produce to close dimensions. Because of the resiliency, however, close tolerances are not usually required. Also, all grades are subject to dimensional changes due to humidity levels, which affect accuracy.

Laminated plastics have been developed to meet special structural and special production requirements. Fine-weave line grades can be machined with intricate shapes. Some grades have been developed for hot punching; others for cold punching. Some laminates have been developed specifically for use as gears.

Easy machinability has characterized laminated plastics but this does not hold for glass, asbestos and graphite grades. They are machined with similar techniques and tools. Machining of these materials is usually economically justified only if the

machining plastics

required shapes cannot be made by molding. Tools for cutting these materials have greater clearances than those for metal because the feeds are greater and the heel of the tool might drag. Tool rake should be slight or negative.

With these three grades, speed should be reduced, about 50 percent of that used for other laminates, and feeds should be increased if the part will stand it. Speed is reduced to lower the heat build-up and to reduce tool wear caused by the highly abrasive bases. Carbides are almost a necessity for cutting these materials and diamond impregnated tools are often justified. Cooling is desirable but not a necessity. Air cooling is usually used because liquids tend to cake the dust. A good dust exhaust system should be used when these materials are cut, especially glass-base laminates.

Glass-reinforced epoxy resin laminates are handled in the same way as the standard laminates. Carbide-tipped cutting bits are used with rake angles, clearances, etc., similar to those used when cutting hard wood. High speeds, medium feeds and large chip clearance are required. Glass fiber filled melamine formaldehyde molding materials are not recommended for machining. When threads are needed in parts of this material, it is much better to mold in inserts.

Machining Processes

It is important to remember, when setting up machining steps, that plastics usually have larger coefficients of thermal expansion than metals. Because of this, 77 F has been designated as the standard temperature at which plastics parts should be inspected. Unusual service conditions of temperature or humidity are taken into account as necessary. Also, characteristics of specific plastics should be known so that stress-relieving anneals can be scheduled if required.

In general, rotary tools are run at higher speeds when cutting plastics than when cutting metals, to prevent edge chipping. Clearances are larger so that chips can be ejected rapidly. A rubbing chip can mar the surface and greatly increase frictional heat.

Because of the high resiliency of plastics, special steps are required to prevent inaccurate machining. Sufficient stock must be left, for example, so the tool will remove material rather than sliding over it as the part flexes out of the way. Also, plastics machining tools are usually designed to remove material by scraping rather than cutting.

Since the resiliency of plastics bears a direct relationship to temperature, at least one manufacturer is machining plastics at low temperatures. At low temperatures, some organic plastics undergo changes that are irreversible. Information on properties of indivdual plastics is readily available and it should be checked so that irreversible changes are not introduced.

Reversible changes include: dimensional changes due to thermal contraction and loss of moisture, in-

Table 3—Standard Dimensions for Band Saws (used with acrylics)

W	idth of Saw	Points to Inch		Minimum	Cutting Radius
	(inches)	(No.)	Blade Ti (inches)	hickness (gage)	(inches)
	3/16 1/4 3/8	7 7 6	0.028 0.028 0.028	22 22 22	1/2 3/4 11/2
	1/2 5/8 3/4	5	0.032 0.032 0.032	21 21 21	21/4 3 41/2
	11/4	3 3	0.035 0.035 0.035	20 20 20	8 12 20

creased modulus of elasticity, increased yield and ultimate strengths, decreased ductility and, usually, increased resistance to impact. Irreversible effects include: crystallization, freezing of plasticizers or absorbed water, dimensional changes due to change of state and physical failure due to lack of ductility needed to respond to dimensional changes. When irreversible changes are avoided, low-temperature machining, with or without controlled humidity, can alter mechanical properties to ease machining or

Drawing courtesy Rohm & Haas Co.

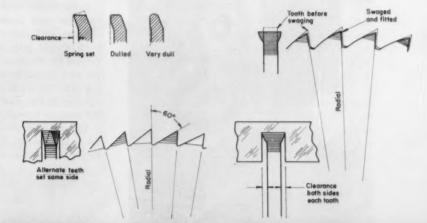


Fig. 3. Alloy steel circular saw blades for acrylics have teeth that are swaged or alternately set. Hollow-ground blades can also be used.

increase accuracy, and can remove heat introduced by the machining. Coolants are not recommended for use on chilled plastics.

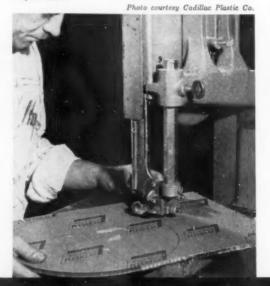
Sawing: Circular, band, panel, jig, veneer and hole saws can all be applied to sawing plastics. When using circular saws, it is important that the blade run true to prevent edge chipping. For cutting pieces 3% inch thick or less, a saw with 8 teeth per inch is recommended. For thicker sections, a saw with 6 teeth per inch works well. Blades vary in diameter from 8 to 18 inches and in number of teeth from 30 to 80.

Many circular saw blades are carbide tipped and have alternate tooth designs (see front cover) to divide the cutting work. Double-beveled lead teeth cut to depth and raker teeth clean the cut for proper width. Inserted-tooth blades tend to be fairly thick, although thinner blades are being developed. Steel blades with varying tooth designs are also available and usually result in a narrower kerf.

Although circular saws give a smoother cut, band saws are often used for straight cuts because they do not retain as much heat. When using a band saw, guides should be set as close to the work as possible. A skip-tooth metal-cutting blade with 4 to 6 teeth per inch is satisfactory for general cutting of plastics without coolants. Saw bands must be kept sharp to prevent gumming of the stock and freezing in the middle of the cut.

When large sheets must be sawed, a panel saw can be used. Because metal saw blades, abrasive wheels or diamond-impregnated cutoff wheels are drawn through a stationary sheet, good accuracy results with a panel saw. Saw blade, motor and spindle travel on rails over the sheet. Hole saws can be used where large holes of the same size are required in large numbers. Standard hole saws are

Fig. 4. Band sawing a circular disk from a flat acrylic sheet.



available in diameters from ${}^5\!\!/_{16}$ to 4 inches. Special large-diameter hole saws have been made by inserting a piece of saw band in a groove machined in a steel disk. The blade is held in place by setscrews.

A cross between an abrasive cutoff wheel and a saw is available for high-speed operations on hard plastics such as epons, silicones, melamines and polyesters. Diamond grit is bonded to the metal surface of the blade. Plastics up to ½ inch thick are sawed with a 0.080-inch-thick blade. Up to 3-inch-thick plastics are sawed with a 0.120-inch blade. Blades 14 inches in diameter and over are 0.160 inch thick.

Recommended blade diameters are:

Material Thickness (inches)	Blade Diameter (inches)				
1/16 to 18	6 .				
3/16 to 1/4	8				
% to 1/2	10 or 12				
5% to 1	12 or 14				
11/4 to 3	16 or 18				

All of these blades can be run at 3600 rpm giving surface speeds up to 15,000 sfpm. Cutting rate is the same for all plastics. Saws cut smoother, work cooler and require less feed pressure at high speeds. Some slitting saws made by the same techniques are only 0.025 inch thick.

Diamond-coated saw bands are available 0.060 inch thick and 0.200 inch wide. Since they are completely coated, they can cut in any direction. Diamond-impregnated tools are especially good when cutting glass-base laminates because the sharp glass fibers prevent loading. When used on unfilled plastics, these tools have a tendency to load.

As a general rule, acrylics can best be cut with power saws. Circular saws are preferred for straight cutting. For maximum service life, up to 250 hours, carbide-tipped blades used with acrylics should not be used to cut other materials. When there is insufficient production to justify carbides, steel blades can be used, Fig. 2. Most of these blades are made of alloy steel, tempered to permit filing and with rake between 0 and 10 deg, Table 2.

Regardless of tooth design, Fig. 3, all teeth should have the same height. Uneven height will cause chipping and may result in blade failure. Each tooth should have the same shape and be side dressed for the same reasons. The hook or rake of the teeth should be uniform, preferably in a radial line with the blade center. Blades should be machine ground or filed because manual sharpening is not accurate enough.

The saw blade should project slightly higher than the piece to be cut. This minimizes chipping. If the kerf tends to close on the retreating edge of the

machining plastics

blade, a slitter can be used. Such closing can dull the saw, built up heat, destroy the cut finish and cause gumming of the edge.

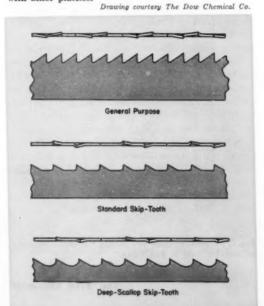
For cutting thin sheets, it is preferable to use a saw that does not have much set. The thicker the stock, the fewer the teeth per inch needed and the greater the clearance required. Large diameter circular saws are best because the teeth have more chance to cool. Larger saws also stay sharp longer and do not gum as quickly.

Circular saws should run with peripheral speeds between 8,000 and 12,000 sfpm. The part should be fed slowly enough to prevent overheating. Feed should be reduced as the blade is leaving the cut to avoid chipping of the corners. An even, steady feed will produce smooth cuts and will result in longer blade life than will a jerky feed. A sliding jig can reduce jerkiness because the masking paper, which is usually left on to protect the surface during sawing, tends to slide unevenly.

Masking paper tends to dull the saw and the adhesive tends to stick to the blade. Adhesive sticking can be minimized by applying a small amount of oil or grease to the blade. This can be done with wick oilers, or by touching a stick of tallow or white soap against the revolving blade. Deposits of any type should be removed from the blade long before it fills the clearance space between teeth.

More power is required to cut acrylic plastics than to cut wood at the same rate. A 2-hp motor is recommended for driving a 10 or 12-inch circular saw. As with other materials, several acrylic sheets can be stacked and cut simultaneously. Stack height should not exceed about 1 inch. Multiple sawing, especially with jigs, will more than pay for

Fig. 5. Typical tooth patterns for saw bands used to cut polystyrene. The same general designs are used with other plastics.



the increased power required.

Small circular and veneer saws can be used with acrylics. These 4 to 5-inch saws must rotate at high speed to achieve proper peripheral speeds. Blades for these saws are usually 0.045 inch thick, have 11 points to the inch and are set 0.025 inch on both sides. These machines are portable and are used to trim large formed parts that would be difficult to manage on a saw table. They can cut developed curves but not compound curves.

Circular saws are effective with cuts up to about 3 feet in length. When longer cuts are required, a panel saw should be used. Sheets can be stacked for multiple cutting and the feed rate ranges from 10 to 25 fpm. Hand feed has the advantage of giving the operator the "feel" of the cut. Hydraulic feed devices, however, do have applications with panel saws. Panel saws are especially useful for sawing sheets that are not protected by masking paper.

Since colorless acrylics contain no fillers, they do not dull saws excessively. If reasonable care is taken to avoid overheating, no coolants need be used. For smooth cuts, particularly in thick materials, coolants are good and will extend the life of the saw. A small stream of coolant directed onto the blade as it enters the cut proves effective.

Band saws are sometimes preferred for straight cuts in thick acrylic parts since the teeth have a chance to cool and there is less chance for binding. Also, since they are thinner, band saws waste less material. Band saws are most used for cutting curves in flat sheets, Fig. 4, or rough trimming formed parts. Internal cuts can be made with a band saw if a blade welder is available. The blade is passed through a hole in the part, welded, annealed and dressed. After the cut is made, the blade is cut. This can save time and money on special jobs but is not recommended for production work. Since little metal is removed from the saw band in such use, however, several cuts and welds can be made.

Some of the newer band machines are designed so that the speed can be changed to suit the job. In general, the thicker the material, the slower should be the speed to prevent overheating. Speed, feed and thickness of stock should be correlated so that each tooth cuts a clean chip. If the speed is too high in relation to the feed, the teeth will rub and heat up rather than cutting free. The blade should run between 2300 and 5000 fpm when cutting acrylics.

Blade thickness, width, and number and type of teeth depend on the size of the saw, the thickness of the material and the minimum radius to be cut. The proper widths of blades for various radii of cut are listed in Table 3. For best results, the widest possible blade should be used. The maximum thickness of the blade is controlled by the diameter of the machine wheels. For 36-inch-diameter wheels, 20 gage is about the thickest material recommended for a hardened blade.

Skip-tooth or buttress saw bands have been developed for use in soft materials such as plastics. They have extra gullet capacity to take care of the large chips formed. Although these teeth are coarse, the shape of the gullet is such that maximum strength is maintained in the body of the blade, even in the narrower widths. These saws have 2, 3, 4 and 6 teeth per inch and are hardened on the tooth edge. When used on comparatively soft ma-

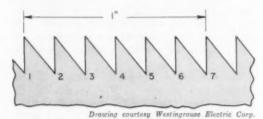


Fig. 6. Band saw tooth design for cutting laminated plastics.

terials, skip-tooth saws will stay sharp for so long that it is more economical to throw them away than to resharpen them.

Tension on the saw band should be just enough to prevent slipping on the wheels. Too much tension will stretch the blade and camber it so that it will not run true. If tension is not enough, the blade will slip and can tear the tires. Acrylic sawdust and masking paper dust can be carried onto the tires and should be cleaned off periodically. If dust builds up, blades will not run true. Stiff bristled brushes can be placed to contact the tires and keep them clean automatically.

Reciprocating movement of a jig saw prevents good chip disposal and leads to gumming. However, jig saws can be used for cutting internal holes and small radii that cannot be practically cut by any other method. They should not be used for thick panels and do not work well with stacked sheets. The part should be backed off frequently during a cut to help clear the chips and to let the blade cool. Heat build-up can be minimized by switching blades frequently. While a blade is cooling, it should be cleaned. For many jobs that the jig saw can do, a spiral-tooth band saw can be used. Work can be cut in any direction with such a blade.

Satisfactory sawing of rigid vinyl plastic parts depends on the prevention of local overheating. Because of this, an underwater saw, fitted with a hardened steel blade, is the most satisfactory tool. The blade should have 10 to 14 teeth per inch and the teeth should be without set. Peripheral blade speed should be between 3500 and 4000 sfpm. Linear blade speed can be between 3 and 4 ipm although rates up to 12 ipm have been used. For low production, where slow cutting speeds are permissible, rigid vinyl sheet stock can be sawed dry on band or circular saws designed for plastics. Whatever methods are used, fine-tooth saws without set are necessary. Increased cutting rates are possible if coolants are used.

Band, circular and jig saws can be used on polystyrene. Because of its better cooling tendency, the band saw is used most; the jig saw is used least. Coolants or air streams give improved results and help to remove chips. Because of greater friction, thick stock should be cut either at lower speed or by a saw with fewer teeth. It is desirable to adjust the saw speed and to use a blade with the number of teeth so that not more than 6000 teeth contact the part per second.

In ordinary band sawing of styrene plastics, numbers of teeth range from 3 to 4 per inch for thick stock; to 10 to 14 for thin stock. Attempts to reduce frictional heat by increasing tooth set are effective but result in a wider kerf and a rougher cut. It has been found that for sections from $\frac{1}{8}$ inch up it is possible to increase cutting efficiency and reduce need for coolant by using a skip-tooth band, Fig. 5, with 4 to 6 teeth per inch. Such bands can be used without coolant for $\frac{1}{8}$ -inch-thick parts. Metal-cutting band saws can be used for cuts in sections less than $\frac{1}{8}$ inch thick but ample coolant is required.

Operating speeds for band sawing styrene should

Drawing courtesy Westinghouse Electric Corp.

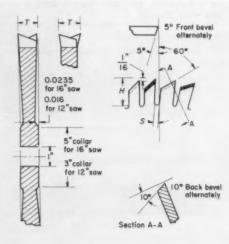


Fig. 7. Typical circular saw design for use on straight or angular cuts in laminates.

machining plastics

be from 465 to 550 fpm. In sawing thick sections, 4 to 5 inches, it is desirable to use a wide band slot to permit clearing of the waste. If possible, the slot disk should be removed. If thick sections are placed on two wooden cleats, parallel with the cut, so the part is 3/4 inch over the table, additional space will be provided for chip clearance.

When sawing polystyrene on a circular saw, hollow ground blades are advantageous. Standard blades can be used if they have adequate set (0.100 inch for a 6-inch-diameter blade $\frac{1}{16}$ inch thick). Blade thickness varies from 0.040 inch for sections up to $\frac{1}{8}$ inch thick to $\frac{9}{32}$ for heavier pieces. Blade thickness should be sufficient to prevent vibration. For general-purpose work, a $\frac{1}{16}$ -inch blade is a good compromise. Diameters of saws used to cut styrene vary from 4 to 10 inches. Since many saws have fixed spindle speeds, smaller blades are used to limit peripheral speed. Ordinary peripheral speeds vary between 3000 and 5000 sfpm, with higher speeds giving better cuts when they can be cooled.

Saw teeth should be of the buttress type, having 45 to 60-deg clearance and zero front rake. Thickness of the work and diameter of the blade determine the number of teeth. For styrene sections less than ½ inch thick, 12 to 15 teeth are used. For heavier sections, 10 teeth are used. One general-purpose 6-inch blade has only 3 teeth per inch. Saws should be flooded with coolant directly above and at the point of operation. Cuts of 2 inches or less in length can be made dry but feed should not be forced. Clearance between the blade and the table should be as small as possible to prevent material from being pulled into the gap.

Jig saws are seldom used because of their inability to remove heat and the difficulties of using coolants with them. Where jig saws are used, they are operated with standard blades at about 875 cycles per minute. For sharp cornered holes, band filing without coolant is recommended but the feed should be light. Routing is a good alternative to the use of a jig saw for many jobs.

Some experience with abrasive cutting wheels has indicated their possible use with styrene parts. For wet cuting, a rubber-bonded wheel 12 inches by $\frac{1}{16}$ inch, operating at 3000 sfpm, has been successfully used when the work was held firmly on both sides of the wheel. Limited experience indicates that a toothless friction cutting blade about 0.025 by $\frac{3}{16}$ can be used for slow cutting of thin material. It results in a smooth cut. On thicker material, a deburring operation is usually required because the melted material tends to cling to the cut edge.

A band saw is well suited for cutting polyethylene but coolants should be used. Pieces should be clamped or held securely. Buttress teeth with a set of 0.004 inch and 4 to 5 teeth per inch give best results. Nylon can be cut on conventional band, jig and table saws without modification. A skip-tooth metal-cutting blade with 4 to 6 teeth per inch is the best when cutting dry. Blades must be kept sharp to prevent gumming and freezing. As with nylon, the fluorocarbons can be cut with conventional saws. Band saws and jig saws give high cutting speeds but tend to leave rough surfaces. A conventional circular saw with a hollow ground blade designed for use with plastics does a good job and leaves a smooth cut. Coolants can be used when cutting either nylon or fluorocarbon parts. Production of

Table 4—Circular Saw Data (used with laminates)

Application	Spindle Speed (rpm)	Blade Teeth (No.)	Blade Diameter (inches)	Tooth Height (inch)	Thickness Including Set (inch)	Tooth Clearance (inch)
Rough Cut® Smooth Cut	2150 2150	100 200	16 16	9/32	5/32	1/16
All Purpose® Tubing Cuts	2860 2860	100	12 12	3/2	3/16 0.095	1/16

^oThese saws have 0.019-inch set. Others are hollow ground to prevent binding.

webs or strings is evidence of overheating.

Any of the expanded plastics can be cut with circular or band saws. They should be cut with the blade moving at high speed and the part advanced with slow speed. Phenolic casting resins are sawed at a surface speed of between 1200 and 1500 sfpm. Jig saws can be used for cutting intricate shapes but can overheat the workpiece.

Laminated plastics, because there are so many grades, resins and bases, represent many different conditions. Most of them can be sawed by the same procedures. The most difficult to saw—asbestos, glass and graphite grades—will be handled as a separate group later.

Band sawing is the simplest method of cutting laminates. They are used for straight cuts where close tolerances and smooth edges are not required, and when material thickness is greater than the ordinary circular sawing range would accommodate. Band saws can handle laminates up to 10 inches thick. Proper tooth set for different classes of work and sharp teeth, Fig. 6, are prerequisites for a good job. When curves are to be sawed, set should be increased as the radius decreases so there will be room in the cut to turn the part. For straight cuts, there should be only enough set to ensure clearance for the back of the blade.

Saw bands should have from 3 to 7 teeth per inch. For ordinary sawing, and for circles 11/4 inch in diameter and larger, 1/2-inch-wide blades with 5

teeth per inch should be used. For smaller circles, blades can be from ½ to ¾ inch wide; for straight cuts, blade width can be up to ½ inches. Blade gage varies from 18 to 20. Operating speeds range from 3000 to 8000 fpm. Feed should be steady and as fast as possible without forcing. Carbon-steel or hardened alloy blades with soft backs are used. Blades should be tempered to permit frequent sharpening.

Circular saws can be used for making straight or angular cuts in laminates. When smooth edges or close tolerances are important, a hollow-ground



Photo courtesy Minnesota Mining & Mig. Co

Fig. 8. Glass-reinforced epoxy sheet can be band sawed with a coarse-toothed blade. With thicker sections, the piece should be backed off occasionally to allow cooling.

blade without set should be used. For rough work, smooth-sided blades with set are satisfactory. Regardless of the class of work, blades have to be sharpened frequently. Dull saws lead to edge chipping. Chipping can also stem from improper blade height. For each thickness and grade of stock, there is only one elevation of the saw above the work that will minimize chipping of both top and bottom of the workpiece. An experimental cut should be made with the blade just protruding through the part. The blade should then be adjusted upward until the smoothest cut is obtained. Blade speed ranges up to 13,000 sfpm and feed should be rapid, steady and unforced.

A 12-inch-diameter saw should be used for ma-

terial up to 1 inch thick. A 16-inch blade can be used for work up to $2\frac{1}{2}$ inches thick, but material this thick can be sawed accurately only with care. Blades are from $\frac{1}{16}$ to $\frac{1}{8}$ inch thick and have from 4 to 8 teeth per inch, depending on the thickness and form of the material, TABLE 4. It is important that all teeth be square, of the same height and free from burrs. Clearance, Fig. 7, should be ample and the cutting edge should be on a radial line or point slightly back of the arbor hole. Rounded gullets help to free chips.

Small laminated tubing can be cut on a circular saw by feeding straight through the blade. Heavywalled tubing, over 3/4 inch in diameter, should be rolled through the saw to prevent excessive breakout.

Sawing of asbestos, glass and graphite grades of laminated plastics can best be accomplished with an ample quantity of coolant and a diamond-tipped saw. Diamond wheels, ½6 inch or more thick, can be used for cutting these grades in thicknesses up to 3 inches. Steel blades can be used in some asbestos grades, but results are not as good. Better cuts can be made with carbide-tipped blades.

If a band saw must be used, work should be fed lightly and the blade should be resharpened often. Glass reinforced epoxy resins can be band sawed, Fig. 8, at a high speed with a fairly coarse blade. Feed is slow and heavy pieces should be backed off occasionally to let the piece and blade cool.

Sawing is generally used for the preparation of blanks, which are then subjected to further machining operations. Blanks and simple parts are also prepared by cutting, which process will be described in a forthcoming issue. The various machining processes applicable to plastics will be covered in articles in this series.

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By Hans W. Smith

Senior Tool Engineer Boeing Airplane Co. Seattle, Wash.

FOR CONVENIENCE IN MEASURING dimensions involving a dovetail, distances are usually shown between a ball or measuring wire and the face to which the dovetail is related. In the case of open angles, Fig. 1, the measurement M consists of a length a, given by the design, plus a length b. The length of b depends on the dovetail angle and the size of the measuring wire d. This length can be obtained from the formula:

$$b = \frac{d}{2} \left(\frac{1 - \sin \alpha}{\cos \alpha} + 1 \right)$$

The parenthetical expression has been calculated for angles from 2 deg to 45 deg, as shown in the accompanying table. Using the table, the distance b can be found by multiplying the value indicated for the angle in question by one-half the measuring wire diameter.

EXAMPLE: For a measuring wire 0.500 inch in diameter and an angle of 30 deg, the value of $b=1.5744\times0.250$ inch = 0.3936 inch.

The accuracy of the measurement b is, of course, affected when the diameter of the measuring wire differs from its nominal value. If the tolerance is

measuring dovetail dimensions

assumed to be positive, the measuring wire diameter can be obtained by adding the nominal diameter d to the tolerance t. The equation now reads:

$$b=\frac{d+t}{2}\left(\frac{1-\sin\,\alpha}{\cos\,\alpha}+1\right)$$
 The change V in the dimension b is then:

$$V=\left(\frac{1-\sin\alpha}{\cos\alpha}+1\right)\,\frac{t}{2}$$
 Example: If the tolerance t in the previous example is

positive and amounts to 0.001 inch, then the variation V of the measurement $b = 1.5774 \times 0.0005$ inch = 0.000787

The equation for determining distance b for a closed-angle dovetail, Fig. 2, is:

$$b = \frac{d}{2} \left(\frac{1 + \sin \alpha}{\cos \alpha} + 1 \right)$$

Values for the parenthetical expression are also listed in the accompanying table.

Example: For a measuring wire diameter of 0.500 inch with an angle of 30 deg, the value of $b=2.7320\times0.25$ inch = 0.683 inch.

Variations in measurement caused by wire diameter tolerances can be determined by applying the formula:

$$V = \left(\frac{1 + \sin \alpha}{\cos \alpha} + 1\right) \frac{t}{2}$$

This formula is applicable when tolerances are positive.

EXAMPLE: If the tolerance in the example above is 0.001 inch, the variation of the measurement $b=2.7320\times0.0005$ = 0.001366 inch.

Values Used in Calculating Open and Closed Dovetail Angles

Angle (deg)	$\frac{1-\sin\alpha}{\cos\alpha}+1$ (open angle)	$\frac{1 + \sin \alpha}{\cos \alpha} + 1$ (closed angle)		
2 3 5	1.9657 1.9490 1.9163	2.0355 2.0537 2.0913		
10	1.8391	2.1918		
15	1.7673	2.3032		
20	1.7002	2.4283		
25	1.6371	2.5697		
30	1.5774	2.7320		
35	1.5205	2.9202		
40	1.4663	3.1445		
45	1.4142	3.4142		

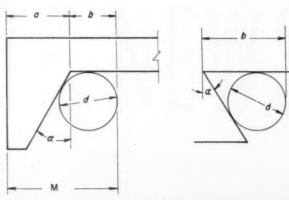
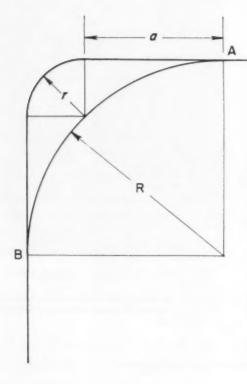


Fig. 1. (left) Dovetail with open angle. Fig. 2. (right) Dovetail with closed angle.

lengthening flanges by increasing bend radii

By Edwin Larkin* Roslyn, Pa.



Occasionally die designers and diemakers find that calculated blanks for dies which have already been built have failed to result in long enough flanges when formed. Such flanges can be lengthened by increasing the bend radius, providing that moderate changes are permissible from a product design standpoint. The problem thus becomes one of cut-and-try calculation to hit upon the correct radius.

An appropriate formula has been developed for calculating the correct radius length increase for a given flange length increase. In the accompanying sketch, R represents the large radius, r the small radius and a the difference between the two radii.

The required radius increase for a given flange increase can be readily calculated by multiplying the flange increase by the constant, 2.329. This constant has been derived as follows:

Distance AB via arc of radius
$$R = \frac{\pi R}{2}$$

Distance AB via arc of radius
$$r = \frac{\pi r}{2} + 2a$$

$$\left(\frac{\pi r}{2} + 2a\right) - \left(\frac{\pi r}{2} + \frac{\pi a}{2}\right) = 2a - \frac{\pi a}{2} = 0.429a$$

An increase or decrease in radius equal to a will increase or decrease flange length by 0.429a. Dividing 0.429 into 1.0 gives the constant 2.329.

^{*} Senior member ASTE Philadelphia chapter



ASTE NEWS

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Mohawk Valley	Worcester

SIX-DAY PROGRAM lined up for Houston

ASTE's Six-Day Houston Convention program beginning Saturday, March 23 through Thursday, March 28, has just been announced.

Foremost among the events are: the meeting of the House of Delegates to elect 14 members of the National Board of Directors; a comprehensive technical program, including symposia on ceramic tooling and plastic tooling; and a rodeo and bar-



becue to wind up ASTE's Annual Meeting in truly Texan style.

All hotel reservations should be sent directly to the hotel and not to the Society nor to any central housing bureau in Houston.

Leading off the agenda the first day will be the meeting of the House of Delegates.

A joint Board and House of Delegates luncheon is scheduled for Saturday, after which the Board of Directors and a closed session of the House of Delegates will meet concurrently.

Following the joint Delegate-Board dinner, the Board of Directors will meet and, if necessary, a continuation of the House of Delegates.





Sunday evening will provide an opportunity for convention goers and their wives to attend the open meeting on "Romance of Oil."

Getting under way on Monday will be the technical program with "Machine Tool in Oil Industry;" and a "Ceramic Tool Symposium," which will continue on Tuesday; "Electronics Help the Tool Engineer;" and "The Designer and the Tool Engineer" which will round out Monday's sessions.

Other highlights of the convention will be "Recent Advances;" "The Professional Engineer and



the Tool Engineer," co-sponsored by the National Standards Committee; and "Management and the Tool Engineer."

Following the National Education Committeesponsored Educators Luncheon on Wednesday will be "Stresses and the Tool Engineer."

On the sixth and last day of ASTE's Houston Convention is to be one of the "biggest and best" in rodeos and barbecues, providing enjoyment and relaxation for convention-goers after the whirl of Annual Meeting activities.

Anniversary

Committee



An all-star group of Texans has been rounded up to head the various committees for the 1956 Houston Convention.

General chairman is H. Otis Traughber of the Preston Machine Tool Sales Co., who is ably assisted by Vice Chairman Paul Langdale of the Engineering Sales Co.

Also on the Host Chapter Committee are NPC Zonal Member Paul E. Brainard of the Tri-Tex Machine & Tool Co.; Charles Hay of the Hughes Tool Co. is serving as secretary.

Division "A" coordinator is Dean F. Saurenman of Schlumberger Well Surveying Corp.; Division "B" coordinator is Homer Briggs of Reed Roller

Meeting



H. Otis Traughber Chairman



Charles Hay Secretary

Bit Co.; Division "C" coordinator is Chris A. Vogt, consulting engineer; and John D. Bailleres of the Dolan Industrial Sales Co. is actively participating in Convention plans as Houston chapter chairman.

August F. Huge of August F. Huge & Son is publicity chairman; Photography Chairman Leland V. Dolan is of the Dolan Industrial Sales Co.; technical sessions chairman is William E. Burndrett of the Engineering Sales Co.

In charge of the reception committee is Thomas M. Nelms, Wessendorff, Nelms & Co.; transportation chairman, P. L. Stallings of Hughes Tool Co.; ways and means committee, Robert E. Schuller of Tri-Tex Machine & Tool Co.; budget, Harry M. Betts of Wessendorff, Nelms & Co.; and Joseph E. Takacs, Hughes Tool Co., is registration chairman.

Chairman of women's activities is Louis F. Skelley III of Schlumberger Well Surveying Corp.; James William Hindman of Cameron Iron Works is serving as emergency chairman; Banquet Chairman George L. Freeman is of the Steel & Machine Tool Sales Co.; tickets chairman is Allen Diener of Steel & Machine Tool Sales; Howard Selby of Selby-Horan Machine Tools is plant tours chairman.

Hospitality chairman is Irvin Buck of the Tool Supply & Engineering Co.; sessions arrangements, T. J. Gilchrist of the Textool Co.; educational activities, Myron L. Begeman, chairman of the mechanical engineering at the University of Texas; records and reports, S. E. Rees; entertainment, Irvin E. Haddon of Peden Iron & Steel Co.; Rodeo Chairman Donald E. Mackenzie of Mission Mfg. Co. is assisted by co-chairman Leo J. Souriall of Allstate Machinery Co.; and George Bo-Linn of Reed Roller Bit Co. is sign chairman.



M. L. Begeman



P. E. Brainard



W. E. Burndrett

L. V. Dolan



H. M. Betts



Homer Briggs



George Bo-Linn



Irvin Buck





G. L. Freeman



A. A. Diener



T. J. Gilchrist



J. W. Hindman



A. F. Huge



T. M. Nelms



S. E. Rees



Dean F. Saurenman



R. E. Schuller



Howard Selby



L. F. Skelley



L. J. Souriall



P. L. Stallings



J. E. Takacs



C. A. Vogt



National President Howard C. McMillen is shown presenting Ozark's charter to Carmen Stra, chairman of ASTE's newly formed 139th chapter.

One hundred and twenty-five members were present when **Trenton-Delaware Valley** chapter received its charter on September 17.

ASTE's National President Howard C. McMillen presented the document to Richard P. Nolan, chairman of the chapter.

Thomas Donovan, past national director and past chairman of Philadelphia chapter, was toastmaster.

Representatives from various ASTE chapters, civic, industrial, educational and local engineering societies were present to give their support to this new chapter.

Ozark chapter in Joplin, Missouri, increased ASTE's chapters to 139 when it was chartered on September 20.

Officers of the newly formed chapter are: C. Stra, chairman; Robert Laster, first vice chairman; Morris Dudgeon, second vice chairman; Jack Smith, secretary; and Claude Roderick, treasurer.

On September 21, Southeast Kansas became the 140th ASTE chapter upon presentation of the charter by Howard C. McMillen.

Other national officers present were: Orville Strahm, National Membership Committee; R. O. White, National Constitution and Bylaws Committee. Marvin Bunting, staff administrator, was also present.

Guests included Winton Jensen, chairman of Kansas City chapter; C. Stra, chairman of Ozark chapter; Norman Watkins, chairman of Wichita chapter; Joe Waller, representative of the mayor; Victor Klotz, superintendent of schools; Al Bynum and Jim Taylor, Coffeyville Chamber of Commerce.

Society Charters Three Chapters



ASTE's National President Howard C. McMillen is shown left, administering the oath of office at the Trenton-Delaware chartering to Richard P. Nolan, chairman; Robert F. Petersen, first vice chairman; Morris W. G. Bahr, second vice chairman; Edwin L. Londahl, secretary; and Roger W. Eichorn, treasurer.



Officers of the newly formed Southeast Kansas chapter and ASTE's National President Howard C. McMillen are pictured: front row, left to right, F. A. Savage, secretary; W. W. Thompson, chairman; H. C. McMillen. Shown, back row, R. B. Sears, second vice chairman; L. M. Schwinn, first vice chairman; and B. L. Wade, treasurer.

members on the

National Vice President George A. Goodwin of Dayton has been named works manager for Master Electric Co. John F. Kruse, also of Dayton chapter, succeeds him as chief process engineer.

National Director Leslie C. Seager is the first ASTE member to become a registered tool engineer, as a result of the recognition of tool engineering as a distinct branch of the engineering profession by the State of Utah. He is also a member of the National Professional Engineering Committee.

Past President Alexander H. d'Arcambal has retired as president and general manager of Pratt & Whitney Co., Inc. He will remain active in company affairs in a consulting capacity and as honorary chairman of its board of directors.

Past President Irwin F. Holland of Hartford has retired as general superintendent of Pratt & Whitney Co., Inc.

Past President Joseph P. Crosby has been designated a member of the National Defense Executive Reserve of the Business and Defense Services Administration of the Dept, of Commerce. Edward P. Gillane of Hartford chapter, executive vice president and director of Pratt & Whitney, will succeed Mr. d'Arcambal as president.

Prof. Myron L. Begeman of the National Education Committee has been elected a fellow of ASME for outstanding contributions to the profession and ing society.

Toledo Chairman Lewis C. Pascoe, formerly assistant to the president of Baker Bros., Inc., is now with New Performance Engineering & Machine Co., Oxford, Mich.

James B. Wilkie, Hartford editorial chairman, has been appointed manager of the gage division of Pratt & Whitney Co., Inc.

Adam Gabriel of Chicago chapter has been chosen "Man of the Year" by the National Management Assn.

William J. Greene of Northern Massachusetts has retired as vice president and director of sales for The L. S. Starrett Co. He is succeeded by Carl O. Newton, former general sales manager and a fellow chapter member. Cortland A. Bassett of Twin States succeeds Mr. Newton.

The metal stamping industry's Presteel Award for 1956 went to **Stanley R. Cope** of South Bend, president of the Acme School of Die Design Engineering.

Houston Past Chairman H. Otis Traughber has joined Preston Machine Tool Sales Co. as sales manager. Formerly with Hughes Tool Co., he is also host chapter committee chairman for ASTE's 1957 convention.

Milwaukee member **Duane R. El**more has been appointed chief engineer by the Inland Steel Products Co.

Philip Lindhuber of Toledo chapter, ASTE representative on ASA Sectional Committee B-6, was a panel member for a program on "The Trend Toward Standardization in the Fluid Power Industry" at the NFPA annual meeting. He is chief tool engineer for Speicer Products.

Stanley Staton, a Detroit member, is now in charge of broach engineering for Detroit Broach & Machine Co.

George A. Daum, member at large, has been appointed manager of manufacturing services at the St. Johnsbury Works of Fairbanks, Morse & Co.

Two Baltimore members have been promoted by the Gerotor May Corp.: Walter F. Kaminski to plant manager and Donald R. Dorff, chapter program chairman, to assistant plant manager.

Wayne Burkhart of Cleveland chapter is now western sales manager for the gage division of Pipe Machinery Co.



Tool Engineer GADGETS

CONTEST

Chances are your Gadget can't do as many things as the robot dreamed up by our cartoonist. But if you've developed a device that makes production or toolroom jobs easier, safer or more efficient, there's still time for you to enter the Gadgets Contest. Cash prizes are being awarded for the best entries. Details elsewhere in this issue.



DETROIT—Chairman Lenard B. Lovings, left, shows guest speakers copy of Detroit chapter bulletin, "Toolcast," announcing their talks. With him are, from left, Col. Holmes, Director Smillie and Mr. Beattie.

Reserve Training, Re-employment Rights Discussed At Detroit

Re-employment rights of servicemen, the various types of reserve training and the long-range effect on employers were topics at Detroit chapter's meeting: "Manpower Utilization—Military and Industry."

Frederick G. Beattie, regional director of the U. S. Dept. of Labor, described the responsibilities of both private and government employers toward returned servicemen in regard to seniority, status and pay. He also explained the moral background of the present re-employment laws.

Col. Arthur A. Holmes, state director of Selective Service, discussed division of the manpower pool to meet both civilian, industrial and military requirements, and what changes would have to be made in case of emergency.

The different functions of ready reserve, standby reserve and the critical skill reserve program were explained, as well as occupational deferments. The critical skill reserve program applies particularly to engineering, scientific and specialized personnel.

Cosponsoring the affair was the State Selective Service Advisory Committee on Scientific and Other Specialized Personnel, of which National ASTE Director Charles M. Smillie is chairman.

Hamilton District Tours Plant

J. W. Jolly, plant manager of Timken Roller Bearing Co., led Hamilton District on a tour of the plant. He gave an illustrated talk showing the principles and applications of tapered roller bearings. Ron Tipping, program chairman, arranged the tour through E. H. Gladding, personnel manager of the Timken plant.

—Russ Wilson

Positions Available

LEADING CARBIDE MANUFACTURER—has two openings for engineers experienced in either outside service or inside tool engineering. Location: one in Chicago area; one at main plant, Kenilworth, N. J. Some travel required. Attractive starting salary plus extremely good future. Write Sales Manager, Adamas Carbide Corp., Kenilworth, N. J.

De Maioribus Named Education Award Winner

Michael F. De Maioribus, 28, of Roseville, Mich. has been selected to receive a 1956 International Education Award of \$350, the National Education Committee has announced.

Because one of the original recipients



was not qualified for a full award, the unused portion will go to Mr. De Maioribus as an alternate winner. A senior honor student at the University of Detroit, he is majoring in mechanical engi-

neering and has had several years of practical experience. He is also a student ASTE member.

Chicago Looks at Future Of Ceramic Cutting Tools

Addressing Chicago's meeting were: Dr. Arthur G. Metcalfe, senior metallurgist of Armour Research Foundation, I.I.T.; and Robert T. Hook, chief metallurgist of Warner & Swasey Co.

Dr. Metcalfe spoke on the comparison between conventional tools and new cuting materials. He discussed the physical, chemical and metallurgical characteristics that affect tool performance.

Mr. Hook discussed applications of ceramic cutting tool material: how and where can ceramics be used, are ceramics out of research and development stage, what are equipment requirements, and what is being done in the machine tool industry to fulfill these requirements.

—L. B. Klemme



SEATTLE—Discussing the evening's talk on airlines maintenance problems are Chairman John Fellows; Speaker Robert Ellis, chief of airlines maintenance of United Air Lines' Northwest Div.; and Program Chairman Vince Dornes. Special guests were two ASTE 1956 International Education Award winners, Roderick S. Hunt and E. James Burnett, Jr., who were summer employees at Boeing Airplane Co. —James H. Testone

Williamsport Hears Carbide Talk

Williamsport chapter's first fall meeting Sept. 10 featured a talk on "Modern Carbide Turning for Small and Large Lot Production."

The speaker, Stanley Brandenburg of Monarch Machine Tool Co., also presented several films on the subject.

-Forrest Johnston

Fond du Lac Discusses Gasoline Sources

J. E. Taylor of Standard Oil Co. of Indiana discussed "Where Tomorrow's Gasoline will come from" at Fond du Lac's meeting at the Elks' Club in Green Bay.

He described the various types of fuels we have today, what is being done about our gasoline for tomorrow, and demonstrated several experiments.

Guests of the chapter were Owen Michel and James Davis of Four Wheel Drive Corp. —Christ S. Stelios

Indianapolis Discusses Powder Metallurgy

On September 6, 75 members of Indianapolis chapter met at the Antlers Hotel. B. T. Collins of Raybestos Manhattan Inc. discussed "Powder Metallurgy." The talk covered types of materials adaptable to produce parts from powder, machining projerties, factors of sintered parts and molds and press equipment required.

-Robert M. Mewhinney

Microswitch Topic at Lansing

Dick Destefano of "Microswitch" spoke to Lansing chapter at the Charcoal House. He discussed the application of precision snap-action switches to all types of automatic and semiautomatic equipment. A mobile display unit was parked in front of the Charcoal House showing the actual application and functions of microswitches.

-R. J. Krumrie



GRANITE STATE—Among those taking part in the chapter's Sept. 18 tour of Portsmouth Naval Shipyard were, from left: Norman Fine, publicity chairman; Robert Lamson, master of shop #37; Gino Magnani, chairman; Commander Eli Roth, shop superintendent and guest speaker; and Robert Ellison, chapter secretary. Members toured the building ways, inside machine shops and many other parts of the shipyard. Commander Roth, describing the potential importance of nuclear power, pointed out that present methods will be used but on a much more efficient basis. (Official photograph U.S. Navy)

—Norman Fine

Tour and Barbecue At Little Rock

The Ben Pearson Co. served an outdoor barbecue prior to a plant tour conducted by Marion Hale, plant superintendent. This company builds the "Rust" mechanical cotton picker and is the largest builder of bows and arrows in the country.

Movies were shown on wild-game hunting with bows and arrows, and Benjamin Pearson, president of the company, and Tom McGehee, purchasing agent, staged an exhibition of the bow and arrow.

—M. Harden

Ceramic Tooling Discussed At Technical Session

More than 125 members of Northern Massachusetts chapter heard a talk on ceramic tooling.

Raymond Jablonski, product design engineer of the Metallurgical Products Dept. of General Electric Co., discussed ceramic tooling in terms of increased cutting speed, reduced cutting time, improved surface finish and lack of temperature increase in the workpiece, and also the relation between ceramic tooling and carbide tooling.

-Herman A. Wojdylak



LOS ANGELES—"Titanium and Its Application" was the topic of George T. Fraser, western sales manager of Rem-Cru Titanium, Inc., at the September chapter meeting. Above are, from left: J. A. Martin, Los Angeles program chairman; Mr. Fraser; and Chairman Frank X. Bale. A Douglas Aircraft Co, film on "High Speed Milling" was also shown.

—Gene Grahn

Explains Critical Shortage of Engineers

Prominent educators, lawyers, doctors and industrialists joined with the engineers of Saginaw Valley chapter Sept. 20 to hear a critical report of the impact of communism on the shortage of engineers.

Dr. Fred C. Schwarz, surgeon and psychiatrist, spoke on "Engineering the Tools of Communist Conquest" to the nearly 300 persons present. He explained to the enthusiastic audience the true nature of communism, which he considered the critical point of the engineer shortage.

Among the many distinguished guests were C. S. Mott, director of General Motors Corp. and president of the Charles Stewart Mott Foundation; E. T. Ragsdale, vice president of General Motors Corp. and general manager of Buick Motor Div.; Ralph Nordyke, general manager of Fisher Body Div.; W. E. Milner, works manager of AC Spark Plug Div.; A. C. Friel, president of Michigan Society of Professional Engineers; and Albert Sobey, president emeritus of General Motors Institute.

—C. E. Bierwirth

Largest Fall Outing At Twin States

On September 8, at the Crown Point Country Club, 165 Twin States members and guests attended the annual fall outing.

The outing committee with Charles Chandler as chairman provided an allday schedule of activities which included golf, archery, horseshoes and fly casting.

A vote of thanks is due the weatherman, the committee and the caterer for a most successful outing.

-V. W. Erickson

Long Island Hears Automation Talk

Jesse Daugherty of the Giddings and Lewis Machine Tool Co. spoke to the Long Island chapter on "Numerically Controlled Machines and Automation. This system, developed by MIT, the General Electric Co., and the Giddings Machine and Tool Co., utilizes a paper tape preparation unit which perforates a paper tape with precalculated numerical data derived from engineering drawings. This tape is then passed through a computer director which processes the information and converts it into phase-modulated electric signals which are then recorded on magnetic tape. The magnetic tape is then placed in the machine tool control unit which picks up the signals from the tape and controls the axes and auxiliary functions of the machine.

Demonstrations of a skin mill machine were given. —Robert W. Bradshaw



TOLEDO Edison representative James Seward described the Atomic Power and Devel. Associates, Inc., at the Sept. 12 technical session. Composed of 33 power systems and 12 industries, it is planning the Monroe, Mich., atomic power facility.

—Robert S. Bollin

Greater New York Honors Old Timers

John H. C. Steele of the American Bosch Arma Corp., discussed "Optical Tooling in Industry" at Greater New York's meeting on September 10. Mr. Steele outlined procedures used to align large machines and to locate precisely the detail parts in a production assembly by use of optical tooling methods. He emphasized the relative newness of optical tooling and pointed out that it offers a stimulating challenge to all manufacturing engineers.

"Old Timers Night" is an established procedure with Greater New York, and 12 past chairmen attended and gave short talks at this meeting. In recognition of his outstanding and faithful work with the chapter for many years, Edward Eckler was made an honorary member by William Reber, chairman.

-Fred W. Bechtold



Shown at left at the National Education Committee Meeting at Headquarters on September 8 are, left to right: A. F. Gould, L. H. Cook, C. W. Moody, O. D. Lascoe, M. L. Begeman, C. J. Oxford, Jr., R. E. McKee, R. J. Bacik, Wayne Ewing, C. C. Lasater, V. R. Daugherty, R. B. Niebusch, E. L. Cutler, and



Frederick Preator. Surprised Wayne Ewing is shown getting down to the business of cutting his birthday cake before the National Education Committee meeting got under way, while other committee members expectantly await their turn to sample. Everyone who knows Wayne will recognize the cigar as his trademark.

Obituaries

Edward L. Addleton of Phoenix chapter, Helas Machine Tool Co.

Harry Featheringill of Indianapolis chapter, tool engineer with Allison Div., General Motors Corp.

Harry S. Miller of Schuylkill Valley chapter, tool and die maker, Penn Line.

Otto S. Mitler, charter member of Northern New Jersey chapter, president of F. A. Brady, Inc.

John J. Muldoon of Detroit chapter, chief engineer of Cogsdill Tool Products.

Carl Roman of Cleveland chapter, tool engineer with Victorian Instrument Co.

Maynard Smith of San Diego chapter, manufacturing engineer at Convair.



LITTLE RHODY—Chapter members look over one of the machines at the Precision Center of Brown & Sharpe Mfg. Co. Henry D. Sharpe, Jr., company president, addressed the group at dinner. The Sept. 6 tour, which led off their fall and winter schedule, was under the direction of Wallace Anderson, general sales manager.

-Richard Kilbane



ST. LOUIS—Registering before their tour of the A. O. Smith Co. are a few of the 200 members who made the trip to the Granite City plant on Sept. 6. They found the automation in the new plant very interesting.

—W. A. Scheublein, Jr.

Monmouth Chapter Begins Second Year

Heat treating of tool steels was discussed by Hugo G. Becker, tool steel manager of Crucible Steel Co. of America, as Monmouth chapter began its second year on Sept. 11 with a combination dinner and technical session.

Mr. Becker showed a film, "Tool and Die Making—Keystone of Mass Production," and presented a panel discussion on tool steel with John G. Thomas, David Hume, Robert Patrick and George Hamamijian, Crucible engineers.

Chairman John L. Webster announced that during its first year the chapter had grown from 130 to 168 members.

-Harry A. Williamson

San Gabriel Valley Hears Optical Tooling Talk

Moderator of Long Beach's panel discussion on "Optical Tooling" was Kenneth M. Nelson of Douglas Aircraft Co., Inc. Mr. Nelson gave a brief history of optical tooling and a resume of A.I.A. Optical Standards, and James Stoltz, owner of Opto Engineering Co., discussed the use of optics relative to machine tools, precision equipment and precision inspection. Specially prepared charts and blackboard diagrams were used in conjunction with the discussion.

Robert Bartmess, optical tooling engineer of Tool Research Co., described his tour as field engineer with the Farrand Optical & Instrument Co.: the problems encountered and achievements of high tolerances.

Another topic of discussion was that given by Ralph Hamilton, optical tooling engineer of Lockheed Aircraft Corp., in optical tooling relative to aircraft, major jigs and fixtures. Specially prepared slides were used in conjunction with the discussion.

-John H. Stacey



SAN FERNANDO VALLEY—Speakers R. E. Lockhard, left, of the Los Angeles Chamber of Commerce, and Prof. Lester Reukema, center, of Berkeley Electrical Div., College of Engineering, University of California, discuss their Sept. 5 talks with Joe Bangs, chapter program chairman. Prof. Reukema described how the atomic age and electronic developments affect industry and tool engineering.

—A. J. Soares

Tour Warner Gear Plant

Members of Muncie chapter toured the Warner Gear plant of Borg-Warner Corp. for their Sept. 14 meeting. W. H. Cortwright, vice president and works manager and a chapter member, was host of the group. —Arthur F. Kurtz

RACINE CELEBRATES TWENTY-FIRST ANNIVERSARY

Celebration of the twenty-first anniversary of its chartering as the first chapter outside of Detroit was tops on Racine's agenda at its first fall meeting.

Eight of the original 35 members are still active and H. D. Hiatt, first chairman and past national director, described how the chapter came to be organized.

President Howard C. McMillen, in his talk, stressed that the main purpose of ASTE is to help members develop and pool ideas, with service on committees and as chapter officers helping to develop leadership.

In a discussion led by Past Chairman Eugene Bouton, members agreed one cause of the current shortage of engineers is management's refusal to hire engineers and designers over 45, although they may be at the peak of their ability.

—Alvin J. Michna



WESTERN MICHIGAN—Special guests at the combined ladies night and kickoff dinner Sept. 18 were: from left, facing the camera, Chairman and Mrs. William Bylsma; Secretary and Mrs. James Rost; Second Vice Chairman and Mrs. James Wagner; and Treasurer George Lensky. In the foreground are National Director and Mrs. Charles Smillie; First Vice Chairman and Mrs. John Pridgeon; and Program Chairman and Mrs. S. Noxon. Mr. Smillie spoke on women's role in making a success of local chapters.

—Joe Antonucci

Better Tools and Dies Subject at Milwaukee

Joseph Pendleton, plant metallurgist of The Carpenter Steel Co., presented the four steps in the use of tool steel for dies by the use of a slide film. First, design it right; second, use the right steel; third, make it right; and fourth, heat-treat it right.

Program Chairman G. Riordan presented the complete program for the coming year to members and guests. Five young men who won the scholarship from the Milwaukee chapter were presented by Roy Radke, chairman of the scholarship committee. To conclude the meeting a color movie film was shown of people, products and progress year, 1975.

—Walter Behrend



FORT WAYNE—Principles of the gas turbine engine were discussed by Burt H. Bouwkamp, right, resident chassis engineer at Chrysler Div. of Chrysler Corp. At left is Alfred E. Peterson, chapter secretary. Special guests at the Sept. 12 meeting were Harry Halstead, Chrysler district sales manager; and William J. Poinsatte, Chrysler dealer, and his son.

—Russ Snyder

Portland Members Tour Willamette Iron & Steel

Portland, Ore. members toured Willamette Iron & Steel Co. and Bingham Pump Co. at their first fall meeting. Their host was Fred D. Mondin, chapter membership chairman and general superintendent of the company's fabrication and machine shops.

Members also celebrated Mr. Mondin's appointment as area lieutenant for the National Membership Committee. —Walter L. Brenneke

MOHAWK VALLEY DISCUSSES GRINDING

Dr. G. M. Butler of The Carborundum Co. addressed Mohawk Valley at the Club Monarch on "Exploring the Phenomenon of Grinding." He referred to experiments being performed at MIT, and his own research work on abrasives. Thirty members and guests attended the meeting.

—Lloyd C. Shafer



WORCESTER—"The Air Gage as Industry's Most Versatile Inspection Tool" was discussed Sept. 11 by Kenneth G. Wheeler, gage engineer, instrument gage department, Taft-Peirce Mfg. Co., after the chapter had toured its plant. From left are: F. Steele Blackall III, vice president and assistant general manager of Taft-Peirce; John C. Lalor, program chairman; Mr. Wheeler; and Leo P. Tarasov, chapter chairman and member of the National Editorial Committee.

—Leon F. Miller

Erie Tours Oldest Heavy Truck Manufacturer

Members and guests of Erie toured the White Motor Co. on September 14. They were conducted in small groups through the plant, which is one of the oldest independent manufacturers of heavy trucks, and saw the engineering, fabricating, machining, assembling and testing sections.

An unusual feature noted on the tour was that the assembly lines produced successive trucks which were unlike, for they were built to customers' specifications.

Following the tour refreshments were served and a question and answer period was conducted by H. R. Stickel, assistant to the president; Verg Speece, executive engineer; P. E. Tobin, vice president; and Harold Halderman, sales manager. —Leo B. Weiner

Peoria Tours Control Plant

General Electric Co. played host to Peoria chapter at its Sept. 14 meeting as 195 members toured its Multipurpose Control plant at Bloomington.

-George K. Davison

Tri-Cities Hears Talk on Abrasives

Ercell Stevens, abrasive grain engineer of the Norton Co., addressed Tri-Cities chapter on September 12 at the Rock Island Arsenal.

Mr. Stevens described the application and technique of modern barrel finishing in terms of type of finish of the individual items. He outlined which type of barrels and abrasive material should be used in cleaning, polishing and stock removal processes.

-Donald Shewry



BINGHAMTON—Speaker Walter Arrufat, second from right, of ASTE's steering committee on plastic tools, shows samples to Chapter Chairman Wendell Harper, left; Merle Smith, technical assistant to Mr. Arrufat; and Program Chairman Jud Wheeler. An associate engineer at IBM, Mr. Arrufat spoke on "Plastic Tooling and Its Place in Industry" and reported on the progress made in the ASTE plastic tooling research program.

—Glyn Williams



Members of the National Finance Committee pause during their meeting Sept. 15 at National Headquarters to listen to Allan Ray Putnam, assistant executive secretary, far left, explain a point. Listening are, from left: President Howard C. McMillen; Treasurer John X. Ryneska; Robert J. Pioch; Duane H. Brighton, vice chairman; Frank J. Hausfeld, Jr., chairman; Harry E. Conrad, executive secretary; Andrew Cirbus; Bruce A. Fairgrieve; Charles H. Prince, office manager; and Harry N. Anderson, accountant.

Syracuse Picnic Has Record Attendance

For the first time in Syracuse chapter's history, 837 people attended the annual clambake. And for the 19th year, the weatherman provided the chapter with a bright clear day for the festivities at Hinerwadels Grove in North Grove, North Syracuse. Plenty of clams, steamed and raw, clam broth, and regular picnic treats provided an ample menu for the members and their guests.

— Paul H. Hansel

Boston Celebrates Past Chairmen's Night

Mr. Paul Russell of General Electric Co. addressed Boston chapter's "Past Chairmen's Night" meeting on the subject of "Automation." He pointed out that automation increases the demand for labor rather than decreasing it, and that a gradual build-up to automation is preferable to a sudden changeover.

Past chairmen honored were: Cecil Lockwood, 1941-42; Warren Ames. 1943-44; Arthur Nichols, 1945-46; Jack Savits, 46-47; Jack Ryneska, 1947-48, who is national treasurer; Joseph Crosby, 1949-50, a past president of ASTE, and member of the Progress Committee; James Leone, 1950-51; Fred Wells, 1953-54; Karl Nowak, 1954-55; Charles Sadon, 1955-56.

-Melvin P. Burns

Golden Gate Sponsors Drawing and Tool Design

Golden Gate is sponsoring a fall session class on jig and fixture design; die design, blank, pierce, shave; templates; gages. This course, taught by Ernest C. Holden, registered engineer, will be of special interest to those wishing to obtain a basic knowledge of, or refresher of fundamental machine drawing and tool design.

September 19, the chapter met at Spenger's Fish Grotto, where John Hussey of American Tool Works Co. discussed "The Radial Drill as a Drilling and Boring Machine."

-Penn De Roche



SOUTH BEND—"Tooling for Induction Heating" and a slide movie on the ASTE Twelve-Month Plan were highlights of South Bend's Sept. 18 meeting. From left are Paul Roberts, secretary; E. J. Nelson, chairman; Dr. H. B. Osborn, Jr., immediate past president and speaker of the evening; Frank Kowalik, Jr., program chairman; and John Berker, delegate.

—Harold I. Housewerth

Creative Engineering Is Subject at Monadnock

Professor George A. Taylor of the Thayer School of Engineering at Dartmouth College discussed "Methods Improvements and Creative Engineering" at Monadnock's September 20 meeting.

He gave the basic principles of breaking down any operation into its simplest steps, analyzing each step, and reorganizing or changing them to make the job easier or more efficient.

Guests of the educational committee were two students from Keene High School and Keene Teachers College.

-David A. Piper

Hydraulic Press Brake Discussed at Evansville

George Abbe, plant manager of Pacific Industrial Mfg. Co., addressed Evansville chapter on the subject of "The Hydraulic Press Brake." A movie on the subject was also shown.

In addition to the technical program, Richard Miller gave an exhibition of skeet shooting, and a coffee talk on firearms.

—G. L. Lykken

Brazing Methods Topic at Baltimore

One hundred-thirty-one members of Baltimore chapter met at the Engineers' Club to hear A. M. Setapen of Handy and Harmon discuss "Silver Brazing Applications."

Mr. Setapen, with the aid of a motion picture, discussed brazing methods, joint strengths, and filler metal alloys and their applications.

In addition, two colored movies were shown through the courtesy of Glenn L. Martin Co.; "The Intruder" and an informative film on the PGM Seamaster.

-Waldo Womeldort



OKLAHOMA CITY—Chapter members pose around the plaque at the entrance to the Oklahoma City Air Materiel Area before their recent tour of the facility.

-C. A. Leslie, Ir.



Coming Meetings



National

ASTE 25th Annual Meeting and Silver Anniversary will be held March 23 through 28, 1957, at the Shamrock Hilton Hotel, Houston, Texas.

On-Campus Conference

Illinois Institute of Technology— Nov. 2-3, Chicago. "New Horizons in Manufacturing."

Chapter

Ann Arbor Area—Nov. 28, 7 p.m. Industry and Education Night. Panel representing industry and higher education will discuss tool engineering profession as viewed by educators and industrialists. Local high school teachers and students will be guests.

ATLANTA—Nov. 12, Cherokee Restaurant. "Carbide Turning for Large and Small Lot Production" by S. E. Beer, Monarch Machine Tool Co.

Baltimore—Nov. 7, 7:30 p.m., Engineers Club. "Bureau of Standards Developments and Services that Are of Interest to the Tool Engineer" by Frank P. Brown, chief, Shops Div.. National Bureau of Standards.

BATTLE CREEK—Nov. 19, 7 p.m., American Legion Club House. "Automation" by C. F. Hautau, president, Hautau Engineering Co.

Boston-Nov. 8, 6:30 p.m., New England Mutual Hall. Executive and Industry and Education Night.

Cedar Rapids—Nov. 8, 6:30 p.m., Montrose Hotel. Industry and Education Night. "Economics of Tool Design" by Harry Conn, Scully-Jones & Co.

Chicago—Nov. 12, 6 p.m., Nielsen's Restaurant. "The Sky's the Limit— True or False?" by Wesley Kuhrt, chief engineer of gas dynamics, Pratt & Whitney Div., United Aircraft Corp.

CLEVELAND—Nov. 9, 8 p.m., Statler Hotel. "A Method of Reasoning for Tool Engineering" by Joseph I. Karash, manufacturing engineer, Reliance Electric & Engineering Co.

DES MOINES—Nov. 21, 7 p.m., Des Moines Golf and Country Club. Industry and Education Night.

Detroit—Regular section, Nov. 8, "Automation Trends." Carbide section, Nov. 15, "Radioactive Cutting Tools." Education section, Nov. 29, plant tour. ELMIRA—Nov. 5, 7 p.m., Mark Twain Hotel. Industry and Education Night. "Ceramic Cutting Tools."

ERIE—Nov. 6, 7 p.m., General Electric Community Center. Executive night; talk by ASTE National Secretary William Moreland.

FORT WAYNE—Nov. 14, 6:15 p.m., Hobby Ranch House. Harlow Klema, George Gorton Machine Co., will discuss Gorton equipment.

Golden Gate—Nov. 14, Hotel Claremont, Berkeley. "Automation—Cost Reduction through Tool Engineering" by Walter Kasenbohm, executive vice president, Marchant Calculators. Executive night.

Grand River Valley—Nov. 2, 8 p.m., Shep's Hall, Galt. "Apprenticeship Training" by A. H. Moon, assistant superintendent of secondary schools, Ontario Dept. of Education.

GREATER LANCASTER—Nov. 13, 4 p.m., Armstrong Cork Co. plant tour followed by dinner meeting. "The Jets Program" by Harold Skamser, professor of engineering drawing, Michigan State University. Industry and education representatives and local high school science teachers and students have been invited.

Greater New York—Nov. 12, 6:30 p.m., New York Times Service dining room. Industry and Education Night, with prominent speakers from both groups.

Hamilton District—Nov. 9, 6:30 p.m., Brant Hotel, Brantford. Industry and Education Night. A. M. Moon, assistant superintendent of secondary school education, Ontario Dept. of Education, will speak.

HENDRICK HUDSON—Nov. 21, 6:45 p.m.. Circle Inn. "Production Brazing" by Charles McFadden, Selas Corp. of America.



- Indianapolis—Nov. 1, 8 p.m., Antlers Hotel. Executive night. "Engineering a Community Service" by Walter C. McCarty, editor, Indianapolis News.
- Lansing—Nov. 12, small auditorium, new Civic Center. Dinner at 6:30 p.m., meeting at 8 p.m. open to public. "Nuclear Energy" by Malcolm F. Judkins, manager, New Products Div., Firth-Sterling, Inc.
- Lehigh Valley—Nov. 16, 6:30 p.m., Hotel Traylor. At 8 p.m., panel discussion, "What Do Industry and Education Expect from Each Other?" by speakers from Bethlehem Steel Corp., Lehigh University and Wyomissing Polytechnical Institute.
- Long Beach—Nov. 14, 7:30 p.m., Petroleum Club. Education and Executive Night. "Automation in Industry" by J. H. Stansbury, tool engineer, Douglas Aircraft Co.; G. C. Sharp, chief industrial engineer, Chrysler Corp.; L. R. Warner, chief tool engineer, Grayson Controls; R. Bannert, master mechanic, American Can Co. Coffee speaker will be ASTE National Vice President Wayne Ewing. Election of nominating comittee.
- LONG ISLAND—Nov. 12, 8:30 p.m., Garden City Hotel. "Tumbling" by George Grant, Almco Supersheen Corp. Election of nominating committee.
- Los Alamos—Nov. 7, 8 p.m., Little Theatre of high school. "Ultrasonic Machining" by J. L. Lovett, district manager, Raytheon Mfg. Co.
- LOUISVILLE—Nov. 13, 7 p.m. Tour of Naval Ordnance Plant.
- MERRIMACK VALLEY.—Nov. 1, 6:30 p.m., Newburyport. "Work Simplification" by Herbert Goodwin, associate professor of industrial management, M.I.T.

- Min-Hudson—Nov. 13, 6:30 p.m., Nelson House, Poughkeepsie. Industry and Education Night and tenth anniversary honoring past chairmen, as well as area industry and education leaders. "Partnership of Industry and Education" by Maxwell E. Hannum, editorial chairman, National Association of Manufacturers.
- MILWAUKEE—Nov. 8, 6:30 p.m., Allen-Bradley Co. Plant visit, dinner at plant cafeteria. Racine, Madison and Fond du Lac chapters invited.
- MONADNOCK—Nov. 15, 7:15 p.m., Kingsbury Machine Tool Corp. cafeteria. "Development and Application of Cemented Oxide Tools" by H. J. Siekmann, engineer, Metallurgical Products Dept., General Electric Co. National Treasurer J. X. Ryneska will speak.
- Monmouth—Nov. 13, 8 p.m., Joseph's Restaurant, Eatontown. "Modern Carbide Turning for Large and Small Lot Production" by Paul F. Hawkins, Monarch Machine Tool Co.
- MUNCIE—Nov. 13, 6:30 p.m., Delaware Hotel. Executive night. Report on Ball State Teachers College by its president, Dr. John R. Emens.
- Nebraska—Nov. 15, 6 p.m., Cottoner Terrace, Lincoln. Industry and Education night.
- New Haven—Nov. 8, 6:30 p.m., Hotel Garde. "This is Automation."
- Northern Massachusetts—Nov. 20, 7 p.m., Memorial Hall, Athol. "Economic Future of Massachusetts" by Clifford Fahlstrom, assistant vice president, Associated Industries of Massachusetts.
- OKLAHOMA CITY—Nov. 6, 7 p.m., Oklahoma City University. "Metallurgy in Tool Engineering" by "Static" Wilson, chief metallurgist, Halliburton Oil Well Cementing Co.
- OTTAWA VALLEY—Nov. 20, 8:15 p.m., National Museum. "Cost Values of Investment Castings" by B. G. Mac-Kenzie, sales manager, Delora Stellite.
- Peterborough—Nov. 1, 6 p.m., bus leaves Peterborough terminal. Tour of Orenda jet engine plant of Avro Aircraft Co. in Toronto.
- Philadelphia—Nov. 15, 7:45 p.m., Engineer Club. Industry and Education forum.
- PHOENIX—Nov. 12, 7:30 p.m., Westward Ho Hotel. "Ultrasonic Impact Grinding" by W. H. Weed, Jr., advertising supervisor, Raytheon Mfg. Co.
- PORTLAND, ORE.—Nov. 15, 7 p.m. Ladies night and tour of Oregon Saw Chain's new plant.

- RIVERSIDE—Nov. 11, 7 p.m., Victoria Country Club. Industry and Education Night. "Training Geared to the Needs of Industry" by Fay Tinker, director of vocational training, San Bernardino High School.
- ROCHESTER—Nov. 5. "Die Casting" by Gordon C. Curry, Precision Casting Co.
- SAGINAW VALLEY—Nov. 8, Frankenmuth. Industry and Education Night.
- St. Louis—Nov. 1, 8 p.m., Kingsway Hotel. Monarch Machine Tool Co. talk on "Modern Carbide Turning for Large and Small Lot Production."
- SAN DIEGO—Nov. 16, 7 p.m., El Cortez Ballroom. "Description of the Tool Engineer" by National Vice President H. E. Collins; "The Need by Industry for Tool Engineers" by Ben Coogan, general manager, Convair Div. General Dynamics; "Education's Responsibility in Developing Interest in Engineering Careers" by Dr. Love, president, San Diego State College.
- SAN FERNANDO VALLEY—Nov. 7, 7 p.m., Hody's Restaurant. "Meteorology and Precision Jig Boring" by John B. Riley, American Sip Corp.
- SAN GABRIEL VALLEY—Nov. 1, 8:30 p.m.. Rainbow Angling Club. Industry and Education Night. "Education of Tool Engineers" by faculty member. Pasadena City College.
- Santa Clara Valley—Nov. 20, 8 p.m., Old Plantation. Industry and Education Night. Forum panel of educators and industrial executives.
- Toledo—Nov. 14, 7 p.m., Maumee River Yacht Club. "Cold Extrusions" by Robert MacLean, tool engineer, Lake Erie Engineering.
- TORONTO—Nov. 7, 8 p.m., Oak Room, Union Station. "Coolants" by Clyde Sluhan, president, Master Chemical Corp.
- TRI-CITIES—Nov. 14, 6:30 p.m., American Legion club rooms, Moline. "Techniques of Surface Grinding" by John Harrington, The DoAll Co.
- Twin States—Nov. 14, 6:30 p.m., Hartness House, Springfield, Vt. Industry and Education Night. Panel discussion by Burnham Finney, editor, American Machinist; Dean W. D. Kimball, Dartmouth College; H. H. Whitmore, vice president, Jones & Lamson; W. H. Preston, works manager, Joy Mfg.; J. O. O'Leary, principal, Springfield High School.
- Worcester—Nov. 13, 6:30 p.m., Putnam & Thurston's Restaurant. "What Industry Expects of Education" by J. Adam Holbrook, purchasing agent, Morgan Construction Co. Industrial and educational leaders invited.



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Ann Arbor Area—Nov. 28, 7 p.m. Industry and Education Night. Panel representing industry and higher education will discuss tool engineering profession as viewed by educators and industrialists. Local high school teachers and students will be guests.

ATLANTA—Nov. 12, Cherokee Restaurant. "Carbide Turning for Large and Small Lot Production" by S. E. Beer, Monarch Machine Tool Co.

Baltimore—Nov. 7, 7:30 p.m., Engineers Club. "Bureau of Standards Developments and Services that Are of Interest to the Tool Engineer" by Frank P. Brown, chief, Shops Div.. National Bureau of Standards.

BATTLE CREEK—Nov. 19, 7 p.m., American Legion Club House. "Automation" by C. F. Hautau, president, Hautau Engineering Co.

Boston—Nov. 8, 6:30 p.m., New England Mutual Hall. Executive and Industry and Education Night.

CEDAR RAPIDS—Nov. 8, 6:30 p.m., Montrose Hotel. Industry and Education Night. "Economics of Tool Design" by Harry Conn, Scully-Jones & Co.

CHICAGO—Nov. 12, 6 p.m., Nielsen's Restaurant. "The Sky's the Limit— True or False?" by Wesley Kuhrt, chief engineer of gas dynamics, Pratt & Whitney Div., United Aircraft Corp.

CLEVELAND—Nov. 9, 8 p.m., Statler Hotel. "A Method of Reasoning for Tool Engineering" by Joseph I. Karash, manufacturing engineer, Reliance Electric & Engineering Co.

DES MOINES—Nov. 21, 7 p.m., Des Moines Golf and Country Club. Industry and Education Night.

DETROIT—Regular section, Nov. 8, "Automation Trends." Carbide section, Nov. 15, "Radioactive Cutting Tools." Education section, Nov. 29, plant tour. ELMIRA—Nov. 5, 7 p.m., Mark Twain Hotel. Industry and Education Night. "Ceramic Cutting Tools."

Erie—Nov. 6, 7 p.m., General Electric Community Center. Executive night; talk by ASTE National Secretary William Moreland.

FORT WAYNE—Nov. 14, 6:15 p.m., Hobby Ranch House. Harlow Klema, George Gorton Machine Co., will discuss Gorton equipment.

Golden Gate—Nov. 14, Hotel Claremont, Berkeley. "Automation—Cost Reduction through Tool Engineering" by Walter Kasenbohm, executive vice president, Marchant Calculators. Executive night.

Grand River Valley—Nov. 2, 8 p.m., Shep's Hall, Galt. "Apprenticeship Training" by A. H. Moon, assistant superintendent of secondary schools, Ontario Dept. of Education.

Greater Lancaster—Nov. 13, 4 p.m.,
Armstrong Cork Co. plant tour followed by dinner meeting. "The Jets
Program" by Harold Skamser, professor of engineering drawing, Michigan State University. Industry and
education representatives and local
high school science teachers and students have been invited.

GREATER NEW YORK—Nov. 12, 6:30 p.m., New York Times Service dining room. Industry and Education Night, with prominent speakers from both groups.

Hamilton District—Nov. 9, 6:30 p.m., Brant Hotel, Brantford. Industry and Education Night. A. M. Moon, assistant superintendent of secondary school education, Ontario Dept. of Education, will speak.

HENDRICK HUDSON—Nov. 21, 6:45 p.m., Circle Inn. "Production Brazing" by Charles McFadden, Selas Corp. of America.

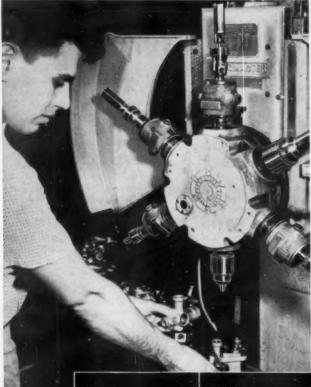


- Indianapolis—Nov. 1, 8 p.m., Antlers Hotel. Executive night. "Engineering a Community Service" by Walter C. McCarty, editor, Indianapolis News.
- LANSING—Nov. 12, small auditorium, new Civic Center. Dinner at 6:30 p.m., meeting at 8 p.m. open to public. "Nuclear Energy" by Malcolm F. Judkins, manager, New Products Div., Firth-Sterling, Inc.
- Lehigh Valley—Nov. 16, 6:30 p.m., Hotel Traylor. At 8 p.m., panel discussion, "What Do Industry and Education Expect from Each Other?" by speakers from Bethlehem Steel Corp., Lehigh University and Wyomissing Polytechnical Institute.
- Long Beach—Nov. 14, 7:30 p.m., Petroleum Club. Education and Executive Night. "Automation in Industry" by J. H. Stansbury, tool engineer, Douglas Aircraft Co.; G. C. Sharp, chief industrial engineer, Chrysler Corp.; L. R. Warner, chief tool engineer, Grayson Controls; R. Bannert, master mechanic, American Can Co. Coffee speaker will be ASTE National Vice President Wayne Ewing. Election of nominating comittee.
- Long Island—Nov. 12, 8:30 p.m., Garden City Hotel. "Tumbling" by George Grant, Almoo Supersheen Corp. Election of nominating committee.
- Los Alamos—Nov. 7, 8 p.m., Little Theatre of high school. "Ultrasonic Machining" by J. L. Lovett, district manager, Raytheon Mfg. Co.
- LOUISVILLE—Nov. 13, 7 p.m. Tour of Naval Ordnance Plant.
- MERRIMACK VALLEY—Nov. 1, 6:30 p.m., Newburyport. "Work Simplification" by Herbert Goodwin, associate professor of industrial management, M.I.T.

- MID-HUDSON—Nov. 13, 6:30 p.m., Nelson House, Poughkeepsie. Industry and Education Night and tenth anniversary honoring past chairmen, as well as area industry and education leaders. "Partnership of Industry and Education" by Maxwell E. Hannum, editorial chairman, National Association of Manufacturers.
- MILWAUKEE—Nov. 8, 6:30 p.m., Allen-Bradley Co. Plant visit, dinner at plant cafeteria. Racine, Madison and Fond du Lac chapters invited.
- MONADNOCK—Nov. 15, 7:15 p.m., Kingsbury Machine Tool Corp. cafeteria. "Development and Application of Cemented Oxide Tools" by H. J. Siekmann, engineer, Metallurgical Products Dept., General Electric Co. National Treasurer J. X. Ryneska will speak.
- Monmouth—Nov. 13, 8 p.m., Joseph's Restaurant, Eatontown, "Modern Carbide Turning for Large and Small Lot Production" by Paul F. Hawkins, Monarch Machine Tool Co.
- MUNCIE—Nov. 13, 6:30 p.m., Delaware Hotel. Executive night. Report on Ball State Teachers College by its president, Dr. John R. Emens.
- Nebraska—Nov. 15, 6 p.m., Cottoner Terrace, Lincoln. Industry and Education night.
- New Haven—Nov. 8, 6:30 p.m., Hotel Garde. "This is Automation."
- NORTHERN MASSACHUSETTS—Nov. 20, 7 p.m., Memorial Hall, Athol. "Economic Future of Massachusetts" by Clifford Fahlstrom, assistant vice president, Associated Industries of Massachusetts.
- OKLAHOMA CITY—Nov. 6, 7 p.m., Oklahoma City University. "Metallurgy in Tool Engineering" by "Static" Wilson, chief metallurgist, Halliburton Oil Well Cementing Co.
- Ottawa Valley—Nov. 20, 8:15 p.m., National Museum. "Cost Values of Investment Castings" by B. G. Mac-Kenzie, sales manager, Delora Stellite.
- Peterborough—Nov. 1, 6 p.m., bus leaves Peterborough terminal. Tour of Orenda jet engine plant of Avro Aircraft Co. in Toronto.
- PHILADELPHIA—Nov. 15, 7:45 p.m., Engineer Club. Industry and Education forum.
- PHOENIX—Nov. 12, 7:30 p.m., Westward Ho Hotel. "Ultrasonic Impact Grinding" by W. H. Weed, Jr., advertising supervisor, Raytheon Mfg. Co.
- PORTLAND, ORE.—Nov. 15, 7 p.m. Ladies night and tour of Oregon Saw Chain's new plant.

- RIVERSIDE—Nov. 11, 7 p.m., Victoria Country Club. Industry and Education Night. "Training Geared to the Needs of Industry" by Fay Tinker, director of vocational training, San Bernardino High School.
- ROCHESTER—Nov. 5. "Die Casting" by Gordon C. Curry, Precision Casting Co.
- SAGINAW VALLEY-Nov. 8, Frankenmuth. Industry and Education Night.
- St. Louis—Nov. 1, 8 p.m., Kingsway Hotel. Monarch Machine Tool Co. talk on "Modern Carbide Turning for Large and Small Lot Production."
- San Diego—Nov. 16, 7 p.m., El Cortez Ballroom. "Description of the Tool Engineer" by National Vice President H. E. Collins; "The Need by Industry for Tool Engineers" by Ben Coogan, general manager. Convair Div. General Dynamics; "Education's Responsibility in Developing Interest in Engineering Careers" by Dr. Love, president, San Diego State College.
- SAN FERNANDO VALLEY—Nov. 7, 7 p.m., Hody's Restaurant. "Meteorology and Precision Jig Boring" by John B. Riley, American Sip Corp.
- SAN GABRIEL VALLEY—Nov. 1, 8:30 p.m., Rainbow Angling Club. Industry and Education Night. "Education of Tool Engineers" by faculty member, Pasadena City College.
- Santa Clara Valley—Nov. 20, 8 p.m., Old Plantation. Industry and Education Night. Forum panel of educators and industrial executives.
- Toledo—Nov. 14, 7 p.m.. Maumee River Yacht Club. "Cold Extrusions" by Robert MacLean, tool engineer, Lake Erie Engineering.
- TORONTO—Nov. 7, 8 p.m., Oak Room, Union Station. "Coolants" by Clyde Sluhan, president, Master Chemical Corp.
- TRI-CITIES—Nov. 14, 6:30 p.m., American Legion club rooms, Moline.
 "Techniques of Surface Grinding" by
 John Harrington, The DoAll Co.
- Twin States—Nov. 14, 6:30 p.m., Hartness House, Springfield, Vt. Industry and Education Night. Panel discussion by Burnham Finney, editor, American Machinist; Dean W. D. Kimball, Dartmouth College; H. H. Whitmore, vice president, Jones & Lamson; W. H. Preston, works manager, Joy Mfg.; J. O. O'Leary, principal, Springfield High School.
- Worcester—Nov. 13, 6:30 p.m.. Putnam & Thurston's Restaurant. "What Industry Expects of Education" by J. Adam Holbrook, purchasing agent, Morgan Construction Co. Industrial and educational leaders invited.

BURGMASTER® 6-Spindle



Turret Drill

increases production 200% at

J. & S. Carburetor Co., Dallas

Here is a "before and after" story which indicates Burgmaster's great ability to increase production, save time, reduce operator fatigue, and improve accuracy and quality of work.

This experience is one of many. If you have a job requiring multiple operations (drilling, reaming, tapping, counter-boring, etc.), this can be accomplished in one setup, with one operator, automatically with a Burgmaster.









This part, shown in production plant photo, is die cast zinc 600 regulator body. Four tapping, one core drilling operations are performed in one setup, using indexing fixture. Production, 32 parts per hour. Rejections, less than 1/2 of 1%. No comparative data available as machine was purchased for this operation.

Vaporizer head (B1112 mild steel) work performed on the circumference and consists of center drill, 2-step drill, drill and chamfer, drill and tap. Work done in one setup on indexing fixture. Production, 17 per hour. Tolerances, .001" in size, .005" in depth. Production increased 200%. Rejections decrease from 4% to less than ½ of 1%. Six drill press, two turret lathe operations were eliminated.

For complete information, write Dept. TE-11



Manufacturing Company, Inc. 15001 South Figueroa Street, Gardena, California

Sales Offices: BIDECHOOD, N. 1.—Burgmaster Eastern Sales Div., | CHICAGO—Burgmaster Machinery Co., 86 N. Maple Ave., Phone: Gilbert 4-3002. | 5329 Lincoln Ave., Phone: UPtown 8-7161. | SAN FRANCISCO—Paul A. Kulju, 857 Estabrook San Leandro, Calif., Phone: LOckhaven 9-2244 SAN FRANCISCO - Paul A. Kulju, 857 Estabrook St.,



CRANE MOUNTED DRILL PRESS

REDUCES SETUP TIME AND SPEEDS WORK

With this crane-mounted radial drill press as much as 60 percent setup and drilling time is saved during the drilling of 1 7/64 and 1 7/16 in. diam holes in the water box for a 100,000 sw ft condenser at Allis-Chalmers. Equipment consists of a crane bridge mounted on the lower crane rails in the erection shop, a trolley that runs laterally to crane movement, a 30-in. diam column and a drilling unit.

A conventional drill press head and arm from a 4-ft radial drill press, modified to suit the adaptation, make up the drilling unit. It is able to drill 3-in. holes in mild steel and 4-in. holes in cast iron. Vertical stroke of the machine's column is about 15 ft and trolley travel about 50 ft.

With this innovation, the operator can position the drill anywhere over the quarter-mile long erection floor. A pushbutton station controlling five motions permits positioning the drill fast and accurately.

AVOID EXTRUDING PROBLEMS WITH CHROME CARBIDE DIES

Two problems ordinarily common to hot extruding brass operations have been overcome through use of chrome carbide dies in the Port Huron, Mich., plant of Mueller Brass Co. according to report by Metallurgical Products Dept. of General Electric Co.

In addition to avoiding these handicaps of unpredictable product size and varying hardness after metal hits subsequent drawing operations, the company also is able to operate its hot extrusion lines on an automated basis as originally designed.

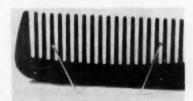
To hold product size with previous dies, it was necessary to change them frequently. This prevented unnecessary cold working later but slowed production. With application of chrome carbide dies, tolerances on specific work are held to \pm 0.006 in., tonnage production is high and one die duplicates work of as many as 20 dies used formerly.

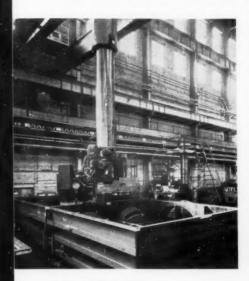
PRODUCE CENTERLESS GROUND WORK TO NEW PRECISION

Material has been accurately centerless ground down to 0.004 in. in the laboratory of Royal Master Inc.'s plant in Riverdale, N. J. using their TG-12 centerless grinder equipped with a regular all-purpose work wheel.

Prior to this minimum diameter to which material could be ground accurately was limited by width of the work rest blade, which had to be narrower than the work being ground. Blade warp, twist and distortion made it difficult to control the blade width. The work size limit accomplished by Royal Master resulted from a new technique of setting up the work rest blade. The operator was able to through feed grind material to the 0.004 in. diam consistently holding a tolerance of 0.0002 in. over the entire 24 in. of material length. Success of the operation also was attributed in part to compact strength of the equipment, operator accessibility and the true-running of the sturdy work wheel spindle.

The finished product is here shown with a common comb for size comparison. Two pins hold the work.





November 1956

DIMPLE IN TUBING INSERT SIMPLIFIES ASSEMBLY

Assembly of part of a Columbia bicycle frame involving a tube and insert posed a problem for company engineers. The part, a vertical member which supports the seat post, encounters considerable stress in service so is reinforced by a short insert which must be brazed to the outside tube.

The short inserted piece is coiled from flat strip into cylindrical shape leaving about a ½-in. gap to permit some radial compression. To provide a force fit and to keep it securely located inside the long tube prior to brazing, the piece is coiled slightly oversize. However, since the operation is done on automatic equipment, the Handy & Harman Easy-Flow silver alloy used in the brazing must be preplaced.



Simple, ingenious solution was found to the problem by pressing a dimple on each side of the insert with an automatic die punch at the time the piece is formed by the coiler. The piece of brazing alloy can then be nested in the punched depression.

To make the assembly, the operator, after removing oxides from the tube,

lays a piece of brazing alloy in each depression and, holding them in place with his finger tips, taps the insert part way into the tube. He then brushes the protruding half of the inserts with flux, and taps the insert down until it is flush with the top of the tube. Thus, the two pieces are assembled with both brazing alloy and flux properly preplaced between the surfaces to be joined. During heating the alloy distributes itself uniformly by capillary action to make a solid continuous joint.

INDUSTRY MAKES USE OF RADIANT HEATING

Engineers designing heating equipment have found that radiant heating offers economy and efficiency. As an example, when annealing cold rolled steel strip and sheet, material being processed should not be reached by products of combustion to cause surface corrosion. This is prevented by passing hot gases through radiant tubes which reached temperatures varying from 1500 to 1750 F according to the treatment involved. The tubes are made usually of heat resistant high alloy castings to withstand these elevated temperatures. Ordinarily the alloys are type HH or HT (Alloy Casting Institute designations). HH alloy, 25 percent Cr and 12 percent Ni, is used where exposure to high sulphur content anthracite producer gas is encountered. HT alloy, 15 percent Cr and 35 percent Ni, is useful in carburizing and carbo-nitriding atmospheres.

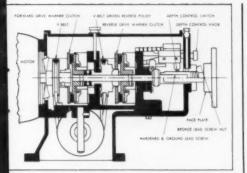
CREATE TAPPING UNIT WITH NO REVERSING MOTOR

Engineering cooperation has resulted in an unusual tapping machine which will tap four holes in a workpiece to different depths, reverse and back out the taps—all while the unit is driven by a motor running continuously in one direction.

Engineers from Ettco Tool Co. and Warner Electric Brake & Clutch Co. created the unit. It is a self-contained, electrically controlled and actuated device developed for fast single or multiple spindle tapping or threading. Use of Warner fractional horsepower forward and reverse clutches eliminates need for a reversing motor while speed of the tapping operation is increased. Torque output of the clutches can be varied by a rheostat control, providing sensitivity needed for small taps as well as power to drive large taps.

Because actuating force is the same as the motive force, engagement and release of the clutches can be controlled to operate within milliseconds. There is no end pressure on the lead screw or





Cross-sectional view of the lead screw tapping unit shows arrangement of the forward and reverse electric clutches, as well as depth control system.

taps and threads cut are as accurate as the taps or dies used.

Torque output of the clutches can be changed even during the cycle of operation, providing the unit with unusual flexibility. In addition, torque of the downfeed clutch can be set at a point where the clutch will stall if a tap sticks or hangs up.

AUTOMATIC SKIN TRIMMING SPEEDS PRODUCTION

Development of a device for trimming panels and trailing edges on the B-57 aircraft has speeded up the work while bringing about more economical production.

Prior to this innovation, by the Martin Co. lengthy panels were scribed and cut, then filed manually to the scribe line. In the new automatic trimming process, panels and trailing edges are placed in the trim fixture to hold the panel to the scribe line. A router is then employed to trim the panels according to their position in the fixture. Consequent working time has been reduced an estimated 60 percent.

This automatic trimming development has now become widely accepted and will be used on future models.



Reduce Threading Costs on AUTOMATIC SCREW MACHINES ... with

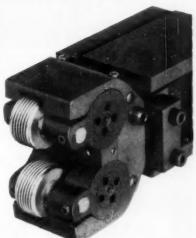
NEW SERIES B



Thread Rolling Attachments

A multi-purpose tool of wide range for rolling machine screw threads, straight and taper pipe threads (including dryseal), annular rings, oil grooves, knurling and other cold forming operations. Eliminates secondary operations by rolling behind shoulders.

- For over 100 different single and multiple screw machines
- Adapters for more than 300 crossslide applications
- Easy to set up and operate
- Simple precision matching with prematched rolls
- Dovetail clamping arrangement simplifies setup by permitting head to be removed from adapter



SELF-COMPENSATING ROLL ACTION simplifies setup, provides longer roll life and reduces down time to a minimum. The side and alignment compensators ease undesirable side pressures on the rolls and assure smooth contact and withdrawal from the work. The advance compensator allows rolls of the same diameter to be used and permits either roll to contact the work first.

FOUR STANDARD SIZES

Model No.	Complete Diameter Range	*Pipe Threads That May Be Rolled	Approximate Number of Common Screw Threads That May Be Rolled
B 10	0 - 5%"	7	80
B 13	1/8" - 13/16"	9	90
B 18	1/4" - 11/8"	15	105
B 36	3/4" - 21/4"	18	185

*Straight and Taper Pipe Threads, including Dryseal (NPTF).
Change may be made from Straight to Taper Threading by changing rolls only. No other equipment is necessary.
ATTACHMENTS DESIGNED FOR SPECIAL APPLICATIONS

REED SERVICE PERSONNEL AVAILABLE to assist with initial installation. Application and Operating Instruction Book supplied with each attachment. Complete satisfaction assured.

Write for Attachment Bulletin B-1

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Specialists in Thread and Form Rolling Tools and Equipment WORCESTER 1, MASSACHUSETTS, U.S.A.

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to save your machining time and reduce waste



AMPCO METAL GRADE 18 CENTRIFUGALLY CAST STOCK BARS



O. D. sizes to which bars finish.

Ampeo Grade 18 Stock Bars are now labeled on one end, for convenience in stocking. Labels show I.D. and

AMPCO METAL, INC.

Dept. TE-11 Milwaukee 46, Wis, West Coast Plant Burbank, California



14 New Sizes! Sizes now range from 14" to 8" I.D., 1¾" to 10" O.D. 12½" lengths.

Purchasing Simplified! Stated sizes are now the sizes to which bars will finish.

New Convenience! Finish allowance, 1/16" on the diameter, both O.D. and I.D. You need make only finish-machine cuts.

Same Dependability! Ampco Metal Grade 18 is a unique aluminum-bronze alloy that resists wear, withstands shock and impact, lasts many times longer than ordinary bronzes. Ideal for bearings, bushings, gears, other parts.

Stock the sizes you ordinarily use in maintenance and tooling - and get other sizes promptly from your nearby Ampco stocking distributor.

Write today for new stock list.

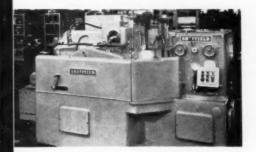
TOOLS

of today

Precision Gear Grinder

Model 140 reciprocating gear grinding machine grinds external precision spur and both right and left-hand helical gears from 8 to 100 pitch. Gears can be ground individually or a number of gears of the same type can be ground simultaneously from hardened steel in preformed or solid blanks. The grinding wheel, which is $12 \times 5 \times 1/2$ to 2 in., is formed to the basic rack form by the automatic Crushtrue_R wheel dressing process.

The grinding operation is similar to hobbing in that work rotates continuously at a rate of speed synchronized with that of the grinding wheel. Spindle



speed of the grinding wheel is 2100 rpm; crushing speed is 116 rpm.

Standard model accommodates a maximum work diameter of 8-in. OD x 5-in. face width. Maximum length between centers is 15 in. Change gears allow from 4 to 192 teeth to be ground, although other capacities can be made available.

Maximum helix angle adjustment of the wheel head is 45 deg right or left hand.

The Sheffield Corp., Dayton 1, Ohio.

Welding Aid

There are no chipping, grinding, or other postweld cleanup operations with the Linde X-7 Anti-Spatter, a silicone-containing emulsion. The material, applied to the spatter area before arc welding, forms a thin protective coat over the weld metal and prevents molten spatter from sticking, so that it is easily removed with a cloth or spray after welding.

Anti-spatter is nontoxic, odorless, and nonflammable. It can be used on any metal without affecting weld quality, and costs less than one cent per square foot of treated surface to use on normal arc-welding operations. It can be applied quickly and easily by cloth, brush or fog spray any time up to two weeks before welding. It will not cake on workpiece or fixtures, and ordinarily requires no special posttreatment where the weld surface is to be painted.

Linde Air Products Co., 20 E. 42nd St., New York 17, N. Y. T-11-1452

Milling Cutters With Throw-Away Inserts

This series of No-grind milling cutters is designed to use low-cost, indexable throw-away carbide inserts with commercial ground thickness tolerances.

The tool is designed with a single simple locking mechanism which has only a wedge and screw to lock and unlock the blade. The wedge has a 15-deg wedge angle which reduces movement of the lock to a minimum of 0.037 in. There are no projections to interfere with chip flow. Concave form of the top of the wedge directs and controls chip flow for free cutting and milling efficiency. The concave design minimizes



wear. Insert location is simple and with assured accuracy because it only involves dropping it into the insert slot.

In the milling cutter, 7-deg axial and radial rakes are automatically provided by the blade slot, and each insert can be indexed to each of its 8 cutting edges before being discarded. No blade adjustment is required when indexing.

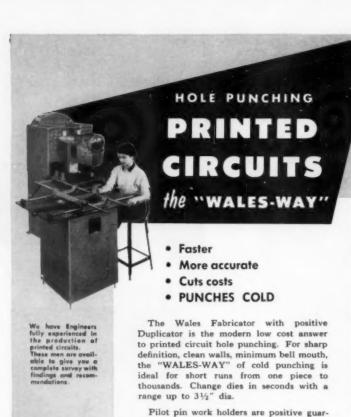
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich. T-11-1453

Production Line Bank

Production stabilizing units are designed to prevent shutting down an entire automatic line because one machine goes down.

The units, which become an integral part of the line, receive a floating and continuously moving bank of parts from the machine ahead and feed the parts as needed into the following machine. Consisting essentially of zigzag gravity feed tracks and parts elevators, they can be used to assure continuity of production of any round part. Design is such that the number of parts in the floating bank may be anywhere from several hundred to more than 5,000 parts.

Tool changes or other adjustments can be made on any machine at any

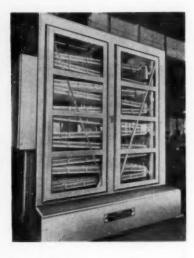


antee of accuracy in every operation and set-up time is thus greatly reduced. The pilot pins guarantee exact relationship of pattern to work piece.

20 ton Fabricator capacity permits punch-

20 ton Fabricator capacity permits punching templates from stock up to ½" thick. Drilling machines, jig borers or other template making equipment is not necessary. The WALES Fabricator-Duplicator combination is a complete shop in itself.





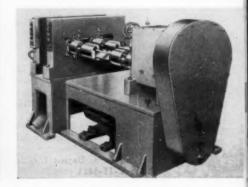
time without causing interruption of production on any other machines in the integrated line. The tower which feeds the machine merely adds parts produced by the preceding machine to those in its floating bank. At the same time, the unit beyond the machine releases parts previously stored in its floating bank to the next machine. As a result, individual machines can be operated at maximum efficiency for planned production periods without being limited by what the machine ahead or behind is turning out.

Gear-O-Mation Div., Michigan Tool Co., 17140 E. Ten Mile Rd., East Detroit, Mich. T-11-1461

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Vertical Mill

This vertical rolling mill, No. 061, designed for the progressive compacting of metal powders, has work rolls in a horizontal plane. Metal powder is fed vertically into the rolls from a hopper located above the roll housings, and a chute arrangement beneath the rolls provides for delivery of the compacted



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-146

strip for sintering.

The mill is driven by a heavy-duty universal drive designed to transmit heavy torque loads to the 6 x 8-in. rolls. Maximum separating force is 150,000 lb. A 15-hp, 4-speed drive permits rolling speeds from 5 to 30 fpm. Roll drive pinions are continuous cut-tooth herringbone type of special alloy steel. There is almost no gear chatter.

The mill has duplex handwheels for screw-in adjustment, and gear ratios permit manual operation under full load.

The Fenn Mfg. Co., Newington, Conn. T-11-1471

Powder Metal Test Dies

Self-contained powder metal test dies are available for briquetting test bearings. Core rods are secured to the die structure without increasing overall length, and pins with hardened chromium steel round dies, are made to Metal Powder Assn. standards for wall thickness.

Lower member of the unit contains spring retainers and guide pin base to



provide a floating action which produces the effect of top and bottom pressure in briquetting. As a result of this action, bearings are produced with uniform density.

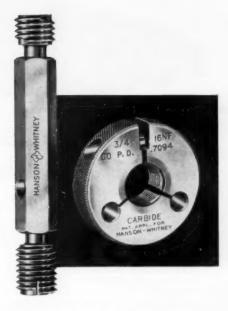
The tool has continuously adjustable fill. Maximum fill is standard at 1 in. but longer fills are available.

Haller, Inc., Plymouth, Mich. T-11-1472

Layout Machine

Wichmann high precision layout machine has two precise straightedges interconnected for cross and longitudinal travel. The unit is used for layout of charts for machines using magnified drawings of parts and contours.

The machine permits a plotting accuracy of \pm 0.002 in. over the entire area. It can be equipped with a turn-



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The integrity of your product is assured by use of Hanson-Whitney machine tools, cutting tools, and precision gages for screw threads . . . engineered and manufactured with single source reliability and precision. Hanson-Whitney alone offers single source product integrity, your guarantee of production perfection.

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TINIUS OLSEN Helps Take the "Shakes" Out of Supersonic Jets

Whirling at speeds in excess of 10,000 rpm, turbine and compressor stages within modern jet engines must be accurately balanced to check destructive vibration.

Tinius Olsen has led in the development of specialized machines that balance jet turbine and compressor stages with unmatched accuracy and at maximum production rates. Awkward, manual handling of parts is eliminated by this conveyorized machine. Complete safety is assured by the air operated shroud which must be lowered before

balancing can be started.



One of the compressor stages of a jet engine is set for rapid accurate balancing on an Olsen Electdyne.



TINIUS OLSEN

TESTING MACHINE COMPANY

Rog. U.S. Pat. Off

Testing and Balancing Machines

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-148



table to permit angular layouts. The machine takes paper, plastic film or glass plates and the plotting (point by point) is done with a scriber, pen or pencil.

Scales, consisting of bands and precision fine-reading dials, are easily interchangeable and can be supplied with any magnification.

Distributed by Eric R. Bachmann Co., Inc., 27-11 41st Ave., Long Island City 1, N. Y. T-11-1481

Welding Machine

Air-hydraulic operated, single phase SX multiple spot electrode welding machine for high production resistance welding consists of a universal multiple gun base with two separate platen units. The platen units, operating independently, load in extended position; then swing in and lift to the welding position. After the welding sequence is completed, they retract and swing out for unloading.

Special superstructure designed to support and locate transformers, welding guns, and the Hydro-Pneumatic Boosters to suit the configuration of particular welding applications are



The Tool Engineer

easily attached to the standard base unit. Components can be rearranged to fit any other application within the capacity of the base unit.

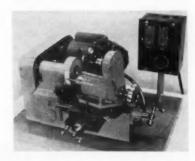
Welding control operates on a 115-v, 60-cycle, single-phase power supply. Operating sequence is initiated with two 24-v, 60-cycle, palm buttons. Emergency stop button, provided for immediate release of the platen, returns the table to the unloading position.

Free standing, floor mounted welding control panel includes a built-in, safe-front, manually operated, 3-pole, 600-v, 200-amp, fusible disconnect switch. The welding control provides for simultaneous or cascade firing of the ignitrons by means of a selector switch. Thus, power demand can be reduced when desirable.

Sciaky Bros., Inc., 4915 W. 67th St., Chicago, Ill. T-11-1491

Small Parts Grinder

This low-cost precision pin grinder will grind lapping pins or special parts



up to a 90-deg included angle.

Dykrex-Roos Corp., P.O. Box 9022,

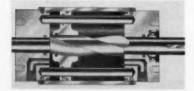
Northeast Station, Newark 4, N. J.

T-11-1492

Rotary Actuator

This rotary actuator is a self-contained, totally enclosed power unit designed to operate on air, gas, water or oil pressure. It delivers a fast and positive rotary motion powerfully and safely by means of a piston and simple internal helix.

The actuator can be stopped at any point in the rotation cycle, and held there indefinitely. There is no bypass



leakage or pressure loss. Because of internal helix, the work load is firmly held in position and cannot back off under reverse tension, shock, or vibration even if a complete power loss occurs.

Standard sizes include 3, 4, 5, 6 and 8-in. diameters. Standard rotation cycles are 0 to 100; 0 to 190; 0 to 280; and 0 to 370 deg. Where required, larger sizes and greater rotation cycles can be furnished.

Carter Controls, Inc., 2800 Bernice Rd., Lansing, Ill. T-11-1493

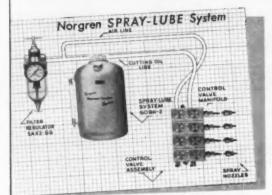
Speed Reducer For Tapping

This Push-Pull tapper, an instant reversing speed reduction unit made for tapping, may be attached to any portable drill. Speed reduction is 7:1 in the driving direction. Direction of the tap can be reversed without stopping the drill motor.

Housing of the unit is held in the finger tips, and any unusual strain can be felt immediately. The tap stops when the fingers are released, and runs in







for
Tapping Machines
Drill Presses
Milling Machines
Grinders
Lathes
Boring Machines
High-Speed Saws
Stamping Presses
Die Lubrication
Other Metal
Working Equipment

Better Lubrication—A better, more uniform spray of cutting oil is applied directly upon the close interface between the tool and work piece. Tool wear is less—saves tool costs, cuts down-time.

Faster Cooling—Because of the larger fluid surface area of the spray and the expansion of the compressed air, heat is dissipated quicker. Cutting can be faster—production stepped up.

Uniform Spray

Air and cutting oil, with flow of each accurately controlled, are conveyed to the nozzle by means of a tube within a tube connection.



Tamper-Proof Controls

Allen-head screws are used on the control valves for adjusting flow of both air and liquid.



Accurate Control of Spray

By adjusting the pressure and the individual outlet controls for air and coolant, spray can be applied in exactly the right quality and quantity for any metal forming job.



Valves Compactly Manifolded

For multi-point application of SPRAY-LUBE, the control valves are designed so that they can be closely assembled in a manifold arrangement.



Compact, Convenient Size

A space only 14"x20"x7" is required for a 2-gallon unit—4 to 12 fluid ounces of liquid an hour per nozzle are sufficient for most operations.



3421 So. Elati St., Englewood, Colo

Without obligation, learn how Improved Norgren SPRAY-LUBE can reduce costs in your plant. Call your nearby Norgren Representative listed in your telephone directory—or WRITE THE FACTORY FOR BULLETIN 337.

Pioneer and Leader in Oil-Fog Lubrication Since 1930

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reverse when the rear housing of the tool is held.

The tool handles all taps up to \%16 in., and five collets are included with the unit.

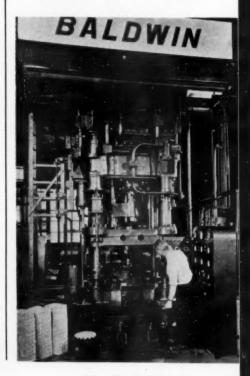
Supreme Products Corp., 2222 S. Calumet, Chicago, Ill. T-11-1501

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Compacting Press

Model 300-H, hydraulic, metal powder compacting press enables fabricators to produce, without additional tooling, such shapes as a double counterbore, which involves a counterbore in each end of the part, or a double hub, which incorporates a hub on each side of a flange. Variation of these shapes also is possible.

The unit is a 300-ton, 4-column hydraulically operated press with the main pressing platen moving down from the top. Mounted on the platen are four



auxiliary cylinders, two of which are connected to an inner top punch platen and two to an outer top punch platen. The main platen exerts a force of 300 tons, and the auxiliary cylinders can be adjusted up to a maximum pressure of 125 tons. Adjustable stops from the main platen to the two punch platens, of 300 tons capacity, permit loading either top punch up to this capacity as long as the total of the two does not exceed 300 tons.

The die platen is equipped with 300-ton adjustable stops to limit its downward movement. The bottom, or ejector platen, is operated hydraulically with a maximum force of 300 tons. Both floating and stationary core rods can be used as needed. The floating core rod can travel with the part during ejection, until the part has cleared the die and expanded enough to release its hold on the rod.

Baldwin-Lima-Hamilton Corp., 545 N. Third St., Hamilton, Ohio.

T-11-1511

Drill Press Attachment

The Automator, an inexpensive automatic feed device for drill presses up to ¾ in. provides automatic down feed and adjustable automatic depth stop and shutoff. It also automatically applies lighter pressure at the end of the



stroke to prevent burring. Regulated pressure prevents crowding and drill damage.

The device is simple to attach, adjust and operate. An electric switch shuts off the drill when hole is through or when stop is reached.

Diamond Tool Co., Dept T-2, Box 32, South Haven, Mich. T-11-1512

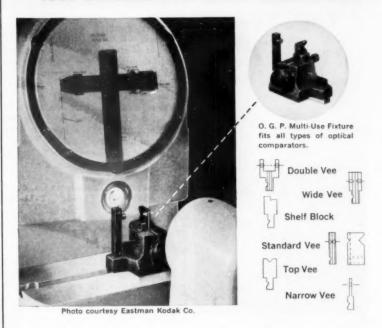
Geneva Movements

Reliable, low-cost conversion of rotary to intermittent or indexing motion is provided by these Genevamatic drives, available both in commercial and precision sizes.

These units are made with 3, 4, 5, 6, 8 indexing stations with any hub, bore-



MULTI-USE FIXTURE PROVIDES LOW COST STAGING FOR MANY SMALL PARTS



O.G.P's NEW Multi-Use Fixture has replaceable part holders designed for holding many types of small parts. Standard holders in varying sizes and shapes are available (see drawings above). Quickly locks into keyway with clamp.

EVERYTHING TO MAKE YOUR OPTICAL COMPARATORS MORE USEFUL

We also supply all types of standard charts, custom charts, layout accessories, fixture bases, and custom fixtures to meet your specialized requirements.

OPTICAL GAGING PRODUCTS, INC. SPECIALISTS IN PROJECTION GAGING

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-151

HERE'S WHERE YOU MEASURE VALUE ...

It's the quality of the production you get from South Bend 10" Precision Lathes that's the measure of their value. Consistently close tolerances, regardless of the job, means a better end product for you, less scrap and lower costs. This is why you get more for your money in South Bend 10" Precision Lathes. Write for catalogbase price \$1174.

SPECIFICATIONS:

Engine and Toolroom models. Swing—10½". Collet capacity—1". Between Centers—14 to 34" max. 24 Spindle Speeds, approx. 27 to 1400 r.p.m., with 2-speed motor.



A NEW CATALOG of 9" to 16-24" Lathes, Turret Lathes, Milling Machines, 7" Shapers, 14" Drill Presses, Pedestal Grinders. Ask for Catalog 5600.

SOUTH BEND LATHE



Builders of Lathes, Milling Machines, Shapers, Drill Presses, Pedestal Grinders

INDICATE A-11-152-1



keyway combination, including ballbearing mounting. Drives, in any number of points, are made with wheel outside diameter from as small as a dime to as large as 20 in. Materials used are mild steel or heat-treated machinery steel.

For economy, commercial sizes are most suitable for use where adjustable center distance of wheel shaft or driver shaft or both are permissible. Precision sizes are used where shafts fit into jigbored housing where center distance adjustment is not provided.

Genevamatic Engineering Co., 404 E. Ellamae, Tampa, Florida. T-11-1521

Automatic Micrometer

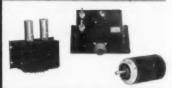
With Model HDR Carson-Dice digital read-out electronic micrometer, exact dimension of a part is determined without influence from human variables. An electronic circuit responds to instant of contact between the micrometer anvil and the work before any pressure is built up on the work by the micrometer screw. A motor drive automatically brings the micrometer quickly and precisely to the point of contact; there is no uncertainty of muscular power in positioning the work or rotating micrometer dials. The digital read-out counter on the front of the instrument shows exact reading in ten-thousandths of an



Infinitely Adjustable

SYSTEMS

FOR INSTRUMENT-



OR INDUSTRIAL-



APPLICATIONS

WacLine Power Systems provide the economical answer to speed control of AC motors under variable or constant-torque applications. Speed is infinitely adjustable over a wide range. Close regulation is readily accomplished even under varying torque. The WacLine system may be applied to single or multi-phase sources on any frequency from 50 to 1000 cycles. Special features such as Program Control. Voltage Signal Response or independent adjustment of forward and reverse speeds are available.

Full Regulation with all the Advantages of AC Motors

- . From .1 oz/in. to industrial power re-
- · Longer Motor life with less mainte-
- · Permits the use of open or hermetically sealed motors.
- · Applicable to explosion proof motors. · Equally effective for large and small
- power requirements. · Simple electronic principle, patent-

pending.



The Tool Engineer

inch. Five divisions between each digit on the unit wheel permits readings to 0.000020 in.

With this counter type, direct reading automatic instrument, unskilled operators can make accurate measurements with repeatability and speed and with no pressure on the work.

Measuring range is 1 in. (% in. with standard micrometer tip), and throat depth is 2 in. Upper head is adjustable in height to accommodate work up to 2 in. Standard anvil is readily removed for use of special fixtures. Repeatability is 0.00002 in.

J. W. Dice Co., Englewood, N. J. T-11-1531

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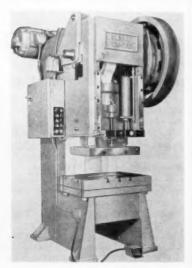
"C" Frame Press

Fabricated steel frame 75-ton fixed base press is available in either flywheel or geared types with single speed or adjustable speed drive for either type.

Long flanged slide with barrel type adjustment and and box type cast construction prevents way deflection and increases guiding to attain slide-to-bed parallelism. Manual slide adjustment is available as an extra. Two pneumatic counterbalances on slide are standard.

Lubrication of the press shown is a press-driven cyclic type automatic oil system, although recirculating oil lubrication system also is available.

Either flywheel or geared type presses are equipped with Minster combination air friction clutch and brake unit mounted on the crankshaft within the flywheel or main drive gear. Centralized press controls for both clutch and drive



are supplied.

Standard stroke of slide is 4 in. with a maximum 8-in. stroke available. Single speeds of 90 or 120 strokes per minute are standard for flywheel type presses and 40 strokes per minute for geared type. Bed area is 24 x 36 in.; slide area is 18 x 24 in.

This G1-75 is also available in the inclinable type. Other capacities of the Minster Series G1 presses are 110, 150 and 200 ton.

The Minster Machine Co., Minster, Ohio. T-11-1532

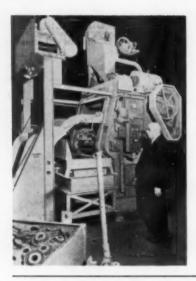
Automatic Blast Cleaner

All operations of this Blastmaster barrel, including material handling, weighing, starting and stopping the rotation of the barrel, are carried on automatically.

In a large operation with high volume, several automatic Blastmaster barrels can be grouped in a line receiving dirty castings from the shake-out by way of a conveyor feeding the loading skip at each machine.

The 12 cu ft Blastmaster barrel il-





lustrated is equipped with a Rotoblast wheel 191/2 in, in diameter with 3-in. throwing vanes. A 15-hp motor drives the wheel which can throw 24,000 lb per

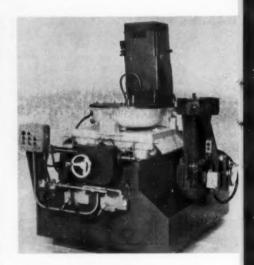
All controls are electrical, while all phases of the cleaning cycle can be controlled separately and manually by pushbuttons on the control board.

The unit can be furnished in 6, 12, 18 and 27-cu-ft sizes.

Pangborn Corp., Hagerstown, Md. T-11-1541

Platen Type Belt Grinder

High-speed precision grinding and finishing of outside diameters may be accomplished with the automatic rotary wet or dry abrasive belt grinder for OD grinding of ferrous and nonferrous



metals, plastics, ceramics, glass and other materials. It is designed to handle circular parts from 26 to 40 in. in diam. and can be modified to meet other diameter ranges.

The self-contained motor-driven worktable rotates at standard speeds of either 3/4 or 3 rpm, with optional change gears for other rpm requirements. Infeed travel of the mechanism which carries rotating parts is adjustable with a minimum of 0.0016 ipm.

An air-hydraulic reciprocating device, with 7-in. oscillation stroke, moves parts back and forth across the belt face to distribute belt wear evenly. The table is adjustable from 0 to 45 deg for angular grinding.

An optional tampico brush attachment is provided for applications requiring deburring. It can be swiveled to coincide with grinding angle of machine table.

Standard abrasive belt size is 8 x 107 in., with belt speed available from 2000 to 5000 sfpm. Capacity of coolant unit, equipped with 1/2-hp coolant pump, is 100 gal.

Engelberg Huller Co., 831 W. Fayette St., Syracuse 4, N. Y. T-11-1542

Automatic Inspection Unit

Magnatest FW-400, an electronic, nondestructive inspection unit for nonmagnetic rod, wire, tube and bar, automatically detects such conditions as seams, overlapping, diameter changes, inclusions, voids, concentrated porosity, metallurgical variation and splits.

The unit itself is a series of instruments designed to cover the whole range of nonmagnetic materials in a range of diameters from 1/64 to 3 in. It is designed for either completely automatic. high-speed operation on production lines or hand operation in laboratories. A typical FW-400 unit can be operated



This new lathe instantly meets every changing speed requirement in the tool room, or quickly sets and holds to any prescribed speed for production runs.

Rugged, Heavy-duty Variable Speed Drive—an oversized unit with double V-belts throughout that delivers positive full-power to the spindle.

the spindle.

High Spindle Speeds—from 200 r.p.m. to 1800 r.p.m. (direct drive), from 40 r.p.m. to 300 r.p.m. in back gear.

Instant and Automatic (power driven) Speed Selection—Only 9 seconds to change from low to high speeds are letther direct drive or backgear. Speeds are changed automatically when T-handle is lifted or pushed into engagement.

High Horsepower at All Speeds—Because the drive unit is oversised, it has larger belts which deliver maximum gripping power at all speeds. A 2 H.P., three Phase motor recom-mended.

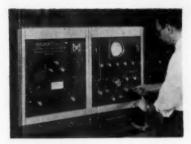
mended.

Additional lathe features: Zero Precision tapered roller spindle bearings, 54 pitch gear box, heavy cast pedestal, tool-room accuracy. Optional accessories include hardened bed ways, L00 long taper key drive or 4" D1 Camlock

apindlea. Sheldon Precision Variable Speed Drive Lathes are available in 11° or 13° Swing. Model WM-55-P (Illustrated) less motor and switch, \$1,944.00 F.O.B. Chicago. Other 10°, 11°, and 13° Sheldon Precision Lathes from \$832.00 up. Also 13° and 15° Sebastian Geared Head Lathes, Sheldon Milling Machines and Sheldon Shapers.

Write for Catalog

SHELDON MACHINE CO. INC. 4229 N. KNOX AVE. . CHICAGO 41, ILL. FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-154



at production speeds in excess of 150 to 300 fpm without an operator. It can be equipped with automatic signalling and recording devices, and works equally well on cut or continuous lengths. Either the absolute or differential types of test can be made.

Three models of the FW-400 series units have been designed. Each one can be equipped with both types of coils in the full range of sizes, the automatic features and all test frequencies. They include a vertical floor mount, which is best suited for permanent production facilities; a console, which accommodates several different units and is designed for the flexibility required in research facilities; and a table model, which is generally best suited for intermittent usage on a limited number of different materials or sizes.

Magnaflux Corp., 7300 W Lawrence Ave., Chicago 31, Ill. T-11-1551

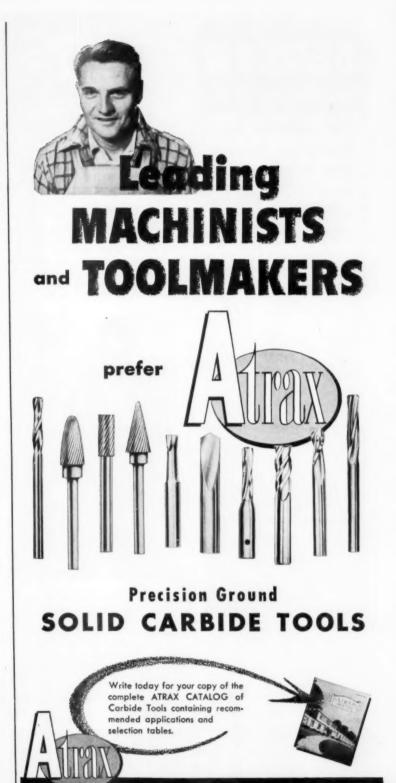
Centerless Turning Unit

Turnomat, a centerless turning machine, employs a centerless bar turning technique and method which involves no centers, steady rests, box tools or bush-

With this unit, it is possible to turn unusual, intricate shapes, contours and tapers of infinite lengths in a single pass or one plunge cut. It handles easily all grades of steel, copper, brass, aluminum, plastics or wood from largest bar stock diameter machine capacity to needle-point diameters. Workpieces can be precision turned to tolerances of ±







ATRAX COMPAN Newington 11, Conn.

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DEVCON makes a precision form of the original . . . without shrinkage or distortion. DEVCON handles like modeling clay . . hardens to strong, tough, metallic piece in two hours . . . can be sawed, tapped or ground with metal-working tools. No heat or pressure is required — unaffected by most solvents, oils, and chemicals.



DEVCON saves money in repairing and rebuilding machinery, tanks and equipment . . . large or small holes in castings can be filled . . . worn pumps and valves built up for longer use. DEVCON bonds to itself, steel, iron, aluminum, brass,

bonds to itself, steel, iron, aluminum, brass, bronze, wood, porcelain and many other materials.

DEVCON is available in four types — write for descriptive Bulletins. Distributed nationally by leading industrial suppliers.

CHEMICAL DEVELOPMENT CORP

300 Endicott Street, Danvers, Mass.

INDICATE A-11-156-1

0.0005 and high finish, without tool chatter or tool marks.

Units are built in three sizes: Models 1000, 1750 and 3500, to handle maximum round bar stock diameters of 1½, 1¾ and 3½ in. respectively. Larger production work models are engineered to special requirements.

Turnomat Co., Inc., Dept. B C, Brockport, N. Y. T-11-1561

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Sander-Grinder

This oscillating spindle sandergrinder utilizes abrasives on work spindles under ¾-in. diameter. It is provided with spindles ¼, ¾, ½ and ¾ in. in diameter.

Arbors or drums carrying the abrasive sleeves can be changed easily. All ar-



bors have taper-shanks which install quickly into a taper-socket type main spindle.

Drums for abrasives over 34-in. diameter may remain permanently on the spindles. The complete arbor, drum and abrasive assembly can be installed, or interchanged with another size, in a few seconds.

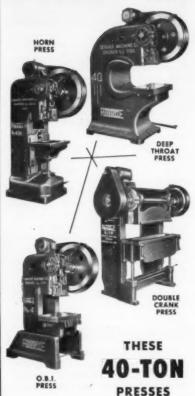
Boice-Crane Co., 934 Central Ave., Toledo 6, Ohio. T-11-1562

Work-Holding Tool

Lightweight, heavy-duty Clamp-All parallels are easy to handle while providing accuracy for holding operations on all types of machines. Individual parallels are finished to a tolerance of 0.0002 in., and matched pairs can be

You Can Rely on a

OUSSELL



take job after job in stride and give you top speed and uniform output on a variety of work. They stress simplicity in every detail to achieve quicker set-ups, easier changeovers and simpler operation. All are extra rugged, high precision units, made to withstand hard usage and assure long, satisfactory service. They are very moderately priced.

Significant savings may result if you let our ongineering staff assist you. There is no obligation.

Rousselle Presses are sold exclusively through leading machinery dealers. Choice of 25 models in 5 to 40-ton sizes.

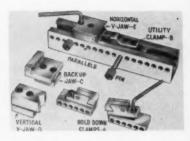
Manufacturers of Rousselle Presses

SERVICE MACHINE CO.

2310 WEST 78th STREET CHICAGO 20, ILL.

INDICATE A-11-156-2

The Tool Engineer



used to hold odd-shaped and larger work. Special interchangeable jaws handle a wide range of workpieces, and will hold all nonmagnetic materials.

There are six attachments: jaw for vertical holding of rounds or shapes; jaws for horizontal clamping of rounds or shapes; clamp which fulcrums on the lower hinge; hold-down clamps, developed with spring loaded feature. Holes in the clamps are verniered so that quick location and minimum locking action is required.

Capacity of the 14-lb unit ranges from 0 to 12 in. The parallels are available in matched pairs with a maximum opening of 65 in.

Jerico, 4744 W Lake St., Chicago 44, Ill. T-11-1571

Coolant Aerator

Large Series #1000 Mel-O-Flo coolant aerators are used on 11/4 or 1-in. coolant lines on large machine tools.

The unit connects directly to the coolant line and mixes atmospheric air with coolant, resulting in a nonsplash aerated



mixture that clings to work and tools. A simple, self-cleaning mechanism purges the coolant aerator of chips and sludge whenever the coolant supply is interrupted. No compressed air line or special plumbing is necessary.

Melard Mfg. Corp., 432 Austin Pl., New York 55, N. Y. T-11-1572

Solvent Detergent

Thorough cleaning ability is combined with safety factors in this clear solvent designed to remove grease, oil and smut from machinery where water cannot be used. The solvent detergent, Composition No. 117, may also be used to clean electrical equipment. It has a flash point of 185 deg, Cleveland open





tells how you can save time and money with







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right away!

Chobert Automatic Riveting!

Latest brochure tells how the Chobert High-Speed Automatic Riveting System works — shows typical blind and open applications where Chobert Automatic Riveting can save you time and money — all clearly illustrated and described. Types of rivets and their basic characteristics plus diagrams are included.

Photographs showing Chobert, "the industry-approved high speed fastening system" in applications covering a wide variety of Aviation, Transportation, Appliance, Architectural and other industrial and commercial uses will help you create new, efficient production shortcuts! Records show Chobert Automatic Riveting does the job faster, better and

for less money than previous methods used by many major firms all over the world. Investigate the Chobert way to cut production costs-get your FREE copy of the Chobert Automatic Riveting brochure by sending coupon-TODAY!





EVELOPMENTS INC. VICTORY BOULEVARD . BURBANK, CALIFORNIA

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PRESENT PRODUCTS.

SEND REPRESENTATIVE

SEND BROCHURE ONLY

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cup. Exposure tolerance rating is two and a half times greater than trichlorethylene and twenty times that of carbon tetrachloride.

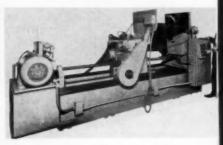
Composition No. 117 is used full strength, applied by brush, or immersion, or a nonatomizing spray. No rinse is necessary, and parts may be blown dry with compressed air. The material may be diluted with up to equal parts high flash petroleum distillate.

Oakite Products, Inc., 158 Rector St., New York 6, N. Y. T-11-1581

Dedenting-Deburring Unit

Combination dedenting and deburring machine removes the dent caused by cutoffs and burr, as well as chamfers or faces both ends of a tube simultaneously.

Mechanically and hydraulically operated, the unit has a tubing capacity of 1/4 to 1 in. in diameter and 11/2 in. to 10 ft in length at rates greater than 3000 pieces per hour. By turning off the



hydraulic dedenting system, it can mechanically deburr tubing in excess of 6000 pieces per hour.

The machine can be quickly changed from one size tube to another by simple adjustment. Clamps are keyed to position and clamping pressure is easily adjusted. Movable head is quickly adjusted by pushbutton control of worm gear reducer.

Bin-loaded parts are automatically fed to the clamping mechanism for work, then automatically ejected. Two 1/2-hp variable speed drives with 8:1 ratios power the spindles.

Tubco Industries, Inc., 14211 Manhattan, Oak Park, Mich. T-11-1582

Eyelet Setting Tools

Flexible, inexpensive tooling for precision, high-quality eyelet rolling is provided by these eyelet setting tools. They are universally adaptable to any machine that has the required reciprocating action.

The eyelet setting tools come in a full range of sizes to set eyelets ranging from 3/64 to 1/8-in. body diameter and

lengths from 1/16 to 7/16. One set of tools will set all lengths of eyelets in any diameter series.

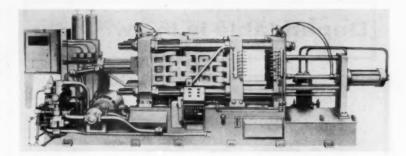
The set of tools consists of five parts: a set die, anvil, spindle, a compression spring, and an adjusting screw. Both set die and anvil assembly are a standard 0.375-in. diameter.

Circon Component Co., Santa Barbara Municipal Airport, Goleta, Calif. T-11-1591

Brinell Microscope

Maximum simplicity is combined with accuracy in reading Brinell impressions in this easy-to-use deep-reading Brinell microscope. Made of stainless steel, it is compact, lightweight and strong, and comes ready to use.

The lens has a 3-way construction and



pumps which deliver 99.7 gpm. This high pump capacity results in a fast cycling machine.

A 200-gal hydraulic reservoir and filter capacity is supplied, which is double the pump output. This is provided to insure maximum pump life.

Massive die plates are cut from solid steel blocks, so deflection is minimized and four large diameter high carbon steel tie bars add strength and resist stretching under locking pressure. Each tie bar is deep hole drilled and can be supplied with indicator rods and indi-



needs no adjustment to the eye. The microscope has a large opening in the side to utilize natural light. In addition, it has a built-in battery-operated light for dark areas or to supplement natural light.

King Tester Corp., 440-44 N. 13th St., Philadelphia 23, Pa. T-11-1592

Die Casting Machine

This 600-ton die casting machine is fast and easy to operate.

Locking pressure is strain gage tested; therefore, this full rated machine will produce castings with minimum of

The hydraulic circuit includes manifold construction with all tubing over 1 in. having flanged fittings welded to the tubes to reduce maintenance.

A 30-hp motor drives two Vickers



OSCILLATING CARBIDE TOOL GRINDER

Write FOR CATALOG The New Hammond Oscillating Carbide Tool Grinder was designed primarily for use with the Anocut Electrolytic Grinding Process. It can also be used for conventional grinding without the Electrolytic "Power Pack".

A controlled and precise method, the Electrolytic process removes stock electro-chemically. It is not to be confused with electro-

spark or electro-arc methods. It reduces diamond wheel consumption 80 to 90%. Outstanding feature is the precision, dynamically balanced, OSCILLATING spindle ... with variable oscillations per minute and variable length of stroke. The operator no longer oscillates the tool . . . the wheel does the work, with greater speed, smoothness, accuracy, and less physical effort.



Hammond Machinery Builders

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-159

Dependable is the word for



Gusher **Coolant Pumps**

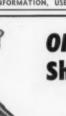
Designed simply, with fewer moving parts to wear, Gusher Pumps are the last word in dependability. Pre-lubricated heavy-duty ball bearings require no further attention. There is no priming or packing necessary. Your Gusher pumps give you instant coolant flow from the moment the machine is started. Specify Ruthman Gusher Coolant Pumps.

Illustrated is a Model VH-6 WP Hammond Abrasive Belt Grinder equipped with a Ruth-man Gusher Coolant Pump.



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-160-1





ONE Drill Grinder Sharpens ALL Drills

- 90° to 140° Included Angle
- 1/8" to 21/2" Diameter
- 2-3-4 Flutes
- Without Chucks or Collets

Write for complete information on the STERLING Model "DV" Drill Grinder





(11" swing-14" between centers)

At LESS Cost

Sterling Model "RK-2" provides more capacity at half the cost of a Universal Grinder. Write for details.

McDONOUGH MFG. CO

1517 GALLOWAY . EAU CLAIRE, WISCONSIN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-160-2

cators for even distribution of locking pressure load.

The universal, automatic timing control panel provides all desired cycles and assures uniform high quality castings. This main electric panel is remoted from machine, so electrical controls are separated from vibration of the machine. Pushbuttons necessary for setup and operation are located within easy reach of the operator.

Size of die plates (vertical and horizontal) is $46\frac{1}{2} \times 46$ in.; space between tie bars (vertical and horizontal) is 28 x 28 in.; die thickness (max and min) ranges from 30 in. max to 10 in. min.; die opening is from 8 to 15 in.; tie bar diameter is 5 in.; thickness of platens is 73/4 in.; the 30-hp motor has speed of 1200 rpm.

Cleveland Automatic Machine Co., Cincinnati 12, Ohio. T-11-1601

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Heavy-Duty Grinder

This heavy-duty machine, designed particularly for grinding long members. will grind either straight surfaces or long-curve irregular surfaces to template contours. It is basically a traveling wheel type with the work remaining stationary. Drive construction is such that there is a smooth flow of power in varying speeds up to 100 fpm.

A vertically movable spindle is mounted on the grinding column which can be moved by means of a compound saddle, a distance of 24 in. toward or away from the work. The saddle is provided with automatic "in" and "out" cross feed and also with automatic vertical adjustment of approximately





48-in. The spindle is mounted to rotate in the vertical plane and is arranged so that grinding can be performed either on the periphery of the wheel or the face of a cup. The spindle is driven with a 30-hp motor at 1200 rpm.

Any length of bed can be used. The one illustrated is 30 ft long with 22 ft of working travel. Provisions are made in a permanent installation for tying the worktable and the base together in order to incorporate suitable coolant collection and return in the foundation.

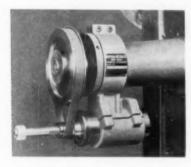
Morton Mfg. Co., Broadway and Hoyt, Muskegon Heights, Mich.

T-11-1611

Grinding Attachment

Angles of slots too small to permit the use of standard size grinding wheels may be ground with this high-speed attachment for use with surface grinders. It also is useful for grinding serrations, T-slots and similar surfaces.

It provides spindle speed up to 14,000 rpm. The attachment also is used for



grinding small radii and small contours in die blocks or other parts.

It may be easily and quickly mounted on the surface grinder spindle. Belt tension is adjusted through use of an eccentric bushing.

Boyar-Schultz Corp., 2000 S. 25th Ave., Broadview, Ill. T-11-1612

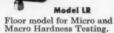
Jig Borer

Three distinct systems of co-ordinate measurements are incorporated in the Omega jig borer. Its 20×32 -in. handscraped table is equipped with trays for utilizing dial indicators and ultraprecision end measuring rods. In addition to the trays, the machine has hardened and ground screws accurate to ± 0.0004 in. in the total table travel of 15×20 in. For advanced type co-ordinate measurement, there is available at additional cost, an optical system equipped with projection type veiwing screens which permits direct reading to 0.0001 in. and



Wilson"Tukon" Micro Hardness Testers





WILSON "TUKON" Micro Hardness Testers meet every fine test requirement. These precision instruments are invaluable in the proper testing of fine precision parts, fine wire, thin metal, shallow superficially hardened surfaces, jewels, plastics, glass, etc. WILSON "TUKON" testers operate with both Knoop and 136 degree Diamond Pyramid Indenters.

Consult with WILSON Engineers on your hardness testing problem

Experienced WILSON Engineers will be glad to help you select the proper model for your particular requirement. This choice depends on the type and thickness of work to be tested, range of loads and other hardness testing equipment available.

Write for Booklet DH-328 on WILSON"TUKON"
Micro Hardness Testers. Ask for DH-325 on
WILSON"ROCKWELL" Hardness Testers.

WILSON "ROCKWELL"...

the world's standard of hardness accuracy

Wilson Mechanical Instrument Division AMERICAN CHAIN & CABLE

230-H Park Avenue, New York 17, N. Y.

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Floor model for Micro Hardness Testing only. (Electrically operated)

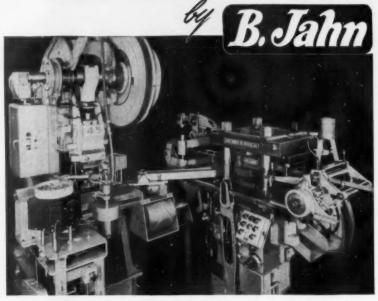


Table model for Micro Hardness Testing only. (Mechanically operated. Also available in floor model)



2 PRESSES . . . 1 PROGRESSIVE DIE . . . 1 STIPPLING DIE . . . ENGINEERING INGENUITY ... SPECIAL MACHINERY ... SPECIAL ELECTRICAL COMPONENTS...

produce AUTOMATION



Here's true automation — 100% automatic production, 100% B. Jahn built, that transforms .025" aluminum into precise meter components 35%" in diameter — each with 720 teeth .009" deep — without human hands, human error!

Equipped with B. Jahn progressive die, one 60 ton press was linked by a chain drive to a 45 ton press incorporating a stippling die.

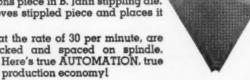


Progressive die, ground all over to guarantee greater accuracy, longer service, less downtime, pierces and blanks intricate discs.

Conveyor system feeds disc into air-operated vacuum arm that positions piece in B. Jahn stippling die. Another arm removes stippled piece and places it on stacking unit.

Completed discs, at the rate of 30 per minute, are automatically stacked and spaced on spindle.

Here's true AUTOMATION, true





Get Full Details On This Astounding "No Hands Error" Automation Application — Send Today for the Big New B. Jah



THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT

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an over-all accuracy of 0.0002 in, in the total table travel.

The Omega jig borer has 16 spindle speeds from 35-1500 rpm. It has a quick-acting, nose type, tool changing device. Maximum distance from spindle nose to table top is 20 in.

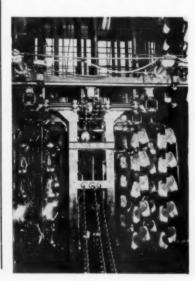
Power for the jig borer is provided by a 11/4-2 hp, 2-speed motor.

Distributed by Amitool Co., 629 Main St., Westbury, L. I., N. Y. T-11-1621

Loading-Unloading Unit

Automatic load-unload mechanism is designed to operate between a metalfinishing machine and a monorail conveyor, to handle work racks on the same time cycle as the finishing machine.

The loader is designed to shuttle on a pair of rails between the metal-finishing machine and the monorail, with



The Tool Engineer

rails either on the floor or in an overhead position. At the top of the loader are two double stations, one for loading and one for unloading. All control mechanisms and drive units for the loader—including gearmotor, electrical devices, chains and sprockets—are located for accessibility. Location of the loader with reference to the finishing machine can be side, end, up or down position.

Hanson-Van Winkle-Munning Co., Church St., Matawan, N. J. T-11-1631

Rivet Spinner

Noiseless spinning riveter head is designed for special production line automatic setups. Adapted from high-speed standard floor and bench model rivet spinners, this unit is air-actuated with

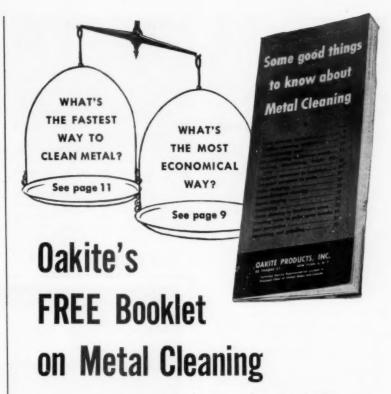


the spinner itself motor driven. It offers flexibility, simplicity of mounting in a variety of applications. Rivet capacity is to $\frac{5}{16}$ in. Spindle travel is $\frac{3}{4}$ in, adjustable downward.

High Speed Hammer Co., 500 Norton St., Rochester 21, N. Y. T-11-1632

Conveyor Lubricators

An improved "100 Series" conveyor lubricator is designed with a completely enclosed nonporous aluminum housing. Crown filters and regulators are standard equipment in the unit. Redesigned trip-mechanism actuates a hunt valve through a cam. There are no complications if the chain backs up, because provision has been made for easy "put-



answers many questions that mean better production, more profit for you. Just look at the table of contents:

Tank cleaning methods

Electrocleaning steel

Electrocleaning nonferrous metals

Pickling, deoxidizing, bright dipping

Applying iron phesphate coatings
in preparation for painting

Applying zinc phosphate coatings

Cleaning, removing rust and
conditioning for painting
in one operation

Machine cleaning methods
Paint stripping
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Better cleaning in hard water
areas
Treating wash water in paint
spray booths
Rust prevention
Machining and grinding

FREE Write for your copy of this 44-page illustrated booklet.





in" and "take-out" of service.

Three types of oil lubricators are included in the series: those for trolleys and chains; for the bearings on slat type conveyors; and those for hot zone applications.

J. N. Fauver Co., Inc. 51 W. Hancock, Detroit 1, Mich. T-11-1641

Air-Powered Screwdriver

Dulcetone air-powered screwdriver, designed to reduce noise level and lessen operator fatigue in assembly operations, runs with a quiet exhaust, controlled by an exhaust system that permits tool to run at full rated speed and power. The specially designed exhaust adds neither excess weight nor bulk. The tool is powered by a lightweight,



high-speed standard Aro 000 series motor.

Models 7500-B and 7501-B can be reversed instantly in operation, without need of releasing lever throttle. Button can be locked for reverse rotation if desired. Adjustable-clutch models can be preset to correct torque requirements. Clutch jaws automatically disengage when screw is set to desired tension. The tool can be easily converted to nutsetter.

Nominal capacity of the screwdrivers is No. 8 free running nuts and machine screws. Speed is 1800 rpm.

Aro Equipment Corp., Bryan, Ohio. T-11-1642

Industrial Controls

Line of "package" industrial controls, provides automatic monitoring and control of almost any chemical or mechanical condition that can be measured electrically. Sensitivities begin with zero to 5 microamperes or zero to 5 millivolts. Normally the units operate on direct current, but may be adapted easily to ac in most cases.

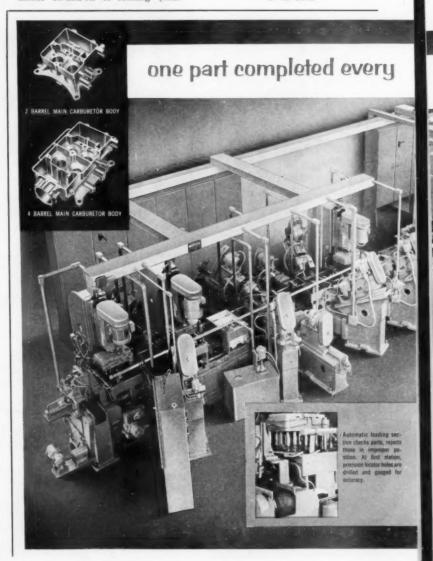
Depending on the circuitry, the units will initiate desired control action when either an increasing or a decreasing signal reaches a present point. Units also are available with both high and low limits. The controls are of the indicating type, calibrated in whatever units are applicable. Control accuracy is held to within 2 percent of dial settings.

Either on-and-off or locking (shut-



off) control action may be selected on most units. Controls are available in either single or multiple meter models, depending on whether one or several signals must be monitored to provide complete control.

Tipp Mfg. Co., Tipp City, Ohio. T-11-1643

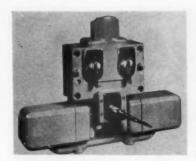


Traverse and Feed Panels

Three series of subplate mounted traverse and feel panels for control of industrial oil-hydraulic systems may be applied to a variety of machine tool and production equipment.

Designated CPP, CPN and CPD, they are available in a broad selection of models and are designed for use with \(^34\)-in. nominal pipe size. Maximum recommended operating pressure is 1000 psi.

Conventional or differential cylinder traverse action models are available. Differential models are used with cylinders having a rod area equal to approximately one-half the piston area for obtaining fast traverse rates with smaller pumps. All models are available in inverted designs and either open or closed center main valve spools.



Two locking type dials in the flow control valve permit independent selection of both fine and coarse feed rates. Adjustment of both rates is infinitely adjustable within the specified range and can be made during actual feeding operation.

Transition from rapid advance

through the successive steps from coarse feed to dwell, is handled automatically within the panel. There are no blind or dead spots between phases. Phases can be initiated by manual, mechanical, electrical or hydraulic actuation of the main spool.

Vickers Inc., Box 302, Detroit 32, Mich. T-11-1651

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Copying Lathe Carbide Toolholder

Designed for economical work, this copying lathe carbide toolholder can be used in machining any alloy including stainless, 52-100, K Monel, etc. at over 600 fpm holding size and finish and with excellent tool life. It also can be used in machining mild steels at ½-in. depth of cut at 400 sfm—0.020 feed. The holder can plunge machine ½ in. deep at 30 deg and on the same part face out on a flange all in one opera-



tion. Neutral or positive rake permits faster metal removal with the same or less hp than with conventional tools. Infinitely adjustable, on-the-job carbide faced chip breaker assures positive action at any speed or feed. Solid carbide, triangular, $3\frac{1}{2}$ in. long toolbits used in the holder are available in all grades.

They can be furnished with any nose radius and any lead angle, positive or negative, to satisfy a variety of machining and finish requirements.

Everede Tool Co., 2000 N. Parkside Ave., Chicago, Ill. T-11-1652

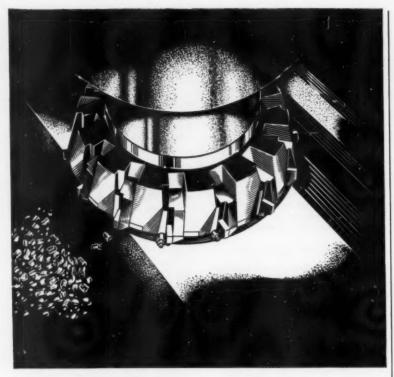
Gap Press

Piping and wiring of all air, lubrication and electrical components are totally enclosed in this gap press. Gears, flywheel, clutch and all other moving parts also are fully enclosed.

Die space area is well lighted for working convenience and there are receptacles and pockets for safety blocks to prevent the press from operating while men are working in danger areas. Service outlets of 440 and 110 volts provide power for portable electric



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"MISTREATED MASS PRODUCTION MANIAC"

hat's the inserted blade carbide tipped milling cutter. Here's a tool that really outperforms ordinary milling cutters when it's used right. It makes possible increased production with more pieces per grind and better finishes at lower cost.

Economical milling with carbides requires careful tool engineering. This has been recognized for many years at Go & Go. Failure to do so has soured many a carbide application.

Go & Go produces a complete line of inserted blade carbide milling cutters including tools designed for specific jobs (specials). We think they're the finest you can buy because sound engineering comes with these cutters. If your application isn't right for them, we'll tell you so. And we'll tell you how to make it right.

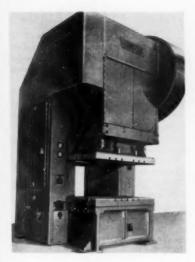
For specifications on a really complete line of inserted blade carbide milling cutters, ask for Catalog "F". Or better still, consult the Go & Go engineering sales representative in your area.



GODDARD & GODDARD COMPANY

Engineering and producing tools that Go & Go since 1917.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-166



service tools while a self-contained air supply system provides air-powered service outlets. An electric indicator shows exact position of the ram at any point in the stroke.

Lubrication system is automatic with all gears totally enclosed and running in oil.

A central lifting hook simplifies setting and moving the press.

Electrical control system includes extra outlets and cams for tying press into automatic lines and for automatically operating ejector type dies.

Verson Allsteel Press Co., 9300 S. Kenwood Ave., Chicago, Ill.

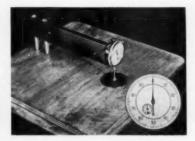
T-11-1661

Thickness Gage

A low-cost gaging device called Evagauge, is designed to provide thickness readings on metal, plastic or rubber sheets, paper and other materials.

This easy-to-use indicator is mounted on a steel arm anchored to a rigid steel foundation on the underside of the 18 x 18-in. table. In performance, the dial indicator operates against a 3-in. round steel anvil in the table and furnishes a reading gage by thousandths from 0.000 to 1.000 in. Throat capacity is 10 in.

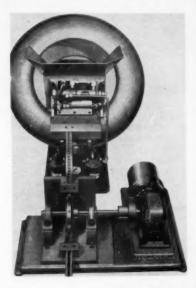
American Evatype Corp., P. O. Box 23 Z, Deerfield, Ill. T-11-1662



Rotary Hopper Feeder

Standard rotary type hopper for automatically feeding clinch nuts is available in two basic hopper sizes: 18 and 24 in., equipped with either gravity or power feed. One or two tracks can be used on the smaller hopper and up to four tracks can be used on the larger. Rated output per track ranges from 150 to 250 pieces per minute.

Feeding system operates on a fully enclosed, continuous duty motor, equipped



with a slip clutch for overloads. The hopper has a three-point mounting for easy installation on rough or uneven surfaces.

Clinch nut feeders are available as a complete system with hopper, track and gravity feed, or hopper and tracks with power feed. Specially designed dies for use with feeder can also be furnished.

Feedmatic-Detroit, Inc., 26901 W. 7 Mile Rd., Detroit 19, Mich. T-11-1671

Induction Heating Unit

This production fixture is used to braze metal assemblies without the use of flux, by induction heating under a controlled atmosphere. Joints produced with this unit are uniformly sound. The process leaves a smooth fillet that requires no cleaning.

Combining induction heating, which provides rapid localized heating, and a controlled atmosphere, this unit can successfully join copper alloys, steel and stainless-steel assemblies on a production basis. Three work stations are operated from a single induction heating unit. High-frequency current is fed to the work coils through coaxial leads. Proper atmosphere is obtained by di-



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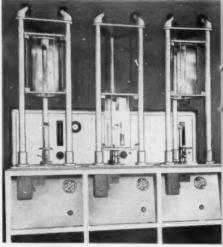
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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-168



recting a continuous flow of purified gas controlled by flow meters at each of the three work stations. Glass bells into which the gas flows are counterweighted to move freely on the posts to facilitate the handling of the work. In the illustration, the bell on the left is in a loading position and the bell on the right in a heating position. Heating cycle is automatically controlled at each station.

Lepel High Frequency Laboratories, Inc., 55th St. and 37th Ave., Woodside, N. Y. T-11-1681

Radius Dresser

Abrasive wheel Somerset Jr. radius dresser, accurate to 0.0002 in., was designed for bench surface grinders. Simple to operate, it shapes and dresses grinding wheel radii, either concave or convex or combinations of both. Although smaller in size than conventional



units, it performs the same dressing operations as larger models.

Any thickness wheel up to and including ½ in. thick can be dressed. There is no need to remove the guard as the wheel is dressed from below so that the operation is open and easy to see. Stop pins allow complete adjustment from 90 through 180 deg. The diamond dressing point is simply set by measuring with a micrometer from top of measuring hood to bottom of dresser arm.

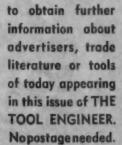
Somerset Tool Co., Virginia St., Hillside, N. J. T-11-1682

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A-11-49	The American Brass Co	. Drawing Brass—Publication B-39 contains data on Formbrite drawing brass (Paste 49)
A-11-298-2	American Cystoscope Makers, Inc	
A-11-13	American Drill Bushing Co	Drill Bushings—Catalog contains data on bushings and 3-D method of ordering. (Page 13)
A-11-13	The American Tool Works Co	. Radial Drills—Bulletin 315 contains operational data on American Hole Wizard Radial Drills. (Page 12
A-11-179 A-11-181 A-11-155	B. C. Ames Co. Armstrong-Blum Mfg. Co. The Atrax Co.	
A-11-158	Aviation Developments, Inc	
A-11-53	W. F. & John Barnes Co	
A-11-277	Boston Gear Works	
A-11-164-2	Cerro de Pasco Corp	Materials—Booklet contains data on low-temperature melting alloys. (Page 204
A-11-156-1 A-11-33	Chemical Development Corp The Cincinnati Shaper Co	
A-11-70	Clearing Machine Corp Division of U. S. Industries, Inc.	. Presses—Catalog contains operational data on Clearing O.B.I.'s. (Page 70
A-11-227	Colonial Broach & Machine Co	
A-11-189-1	Arthur A. Crafts Co., Inc	Cutting Tools—Catalog available on "Complete Carbide Tooling for Au tomation." (Page 189
A-11-42	Crucible Steel Company of America.	
A-11-291 A-11-206	Danly Machine Specialties, Inc H. E. Dickerman Mfg. Co	Accessories—Danly bolster plate accessories described in catalog. (Page 291
A-11-175 A-11-224-3	Elgin National Watch Co.,	Cutting Tools—Eclipse counterbores described in Catalog No. 51. (Page 173 Diamonds—Booklet tells how diamond abrasives assure better metall
A-11-261	Elliott-Myers Corp	
A-11-307	Erickson Tool Co	
A-11-36	Fellows Gear Shaper Co.	Contouring—"The Art of Generating with a Reciprocating Tool" no available.
A-11-264-3 A-11-294	George Gorton Machine Co	Control—Trippit automatic control described in bulletin. (Page 26 Special Machines—Engineering data contained in bulletins 1655, 2595-Di 2004-DS-2511. (Page 29.
A-11-159	Hammond Machinery Builders, Inc.	
A-11-250-2	Huron Machine Products, Inc	
A-11-225	The Ingersoll Milling Machine Co	

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A-11-162	The B. Jahn Mfg. Co	contains application for automation. (Page 162)
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A-11-290	Kennametal, Inc.	Cutting Teels—Bulletin 301 describes Kendex button tools with turn-over throw-away inserts. (Page 290)
A-11-72	Krueger-Barnes Corp	, Special Machines—Booklet describes special machine applications. (Page 72)
A-11-214-1	Louis Levin & Son, Inc.	Drill Presses—Catalog M. describes line of micro-drilling equipment, collets, instrument lathes and precision tools. (Page 214)
A-11-226-3	F. J. Littell Machine Co	
A-11-234		. Carbide Tools—Catalog 56-G contains data on re-working cutters to first
A-11-203	Nelco Tool Co., Inc	. Cutting Tools—Catalog shows over 700 Neico carbide-tipped cutting tools. (Page 203)
A-11-178-1	New York Twist Drill Co., Inc	. Drills—Technical information and net prices contained in catalog. (Page 178)
A-11-45 A-11-278-3	Niagara Machine & Tool Works Northwestern Tool & Eng. Co	Presses—Bulletin 89 D contains data on Niagara Press Brakes. (Pages 44-45) Set-Up Components—Catalog 23 contains data on T-nut & stud sets, step block & clamp sets and punch press sets. (Page 278)
A-11-163	Oakite Products, Inc	. Metal Cleaning Operational data in "Some Good Things to Know About
A-11-281 A-11-249	The O. K. Tool Co., Inc	. Milling Cutters—OK's new multidiam tool book now available. (Page 281) . Cylinders—Bulleuns 105 (Square Line) and 101A (Round Line) contain engineering applications for hydraulic cylinders. (Page 249)
A-11-246	Pines Engineering Co., Inc	Bending Machines—Cost-cutting ideas in bending and end-finishing discussed in Pines News. (Page 246)
A-11-257	The Producto Machine Co	Die Data-Catalog No. 11 and Die Set Digest give tipe for designers, builders and years of dies. (Page 257)
A-11-143		. Thread Rolling—Bulletin B-1 contains engineering data on thread rolling
A-11-149	Ring Punch & Die Co	. Punches and Dies Catalog 105 contains data on Ring standard punches and dies. (Page 149)
A-11-177	Seibert & Sons, Inc	. Tool Control Boards—Seibert control system described in circular T-10. (Page 177)
A-11-308		. Lathes—Bulletin Q-56-C contains operational data on Models LQ and AQ
A-11-194	The Sentry Co	Electric Furnaces—Catalog G-47 describes Sentry electric furnaces. (Page 194)
A-11-61	Sundstrand Machine Tool Co	Machine Tools—Booklet contains data on automatic multi-cycle tracer control for Sundstrand Automatic Lathes. (Pages 60-61)
A-11-189-2 A-11-48	Twentieth Century Mig. Co	Cutting Tools—New selective catalog on cutting tools available. (Page 189) Special Machines—Bulletin 15-T contains specifications for U. S. Multi-
A-11-322	Vlier Engineering, Inc	Slide Machines. Accessories—'56 Vlier Catalog shows applications for Vlier's tooling accessories. (Page 48) (Page 322)
A-11-199	Waldes Kohinoor, Inc	Special Tools—Waldes Truare Grooving Tool described in technical manual. (Page 199)
A-11-168	Wendt-Sonis Co	Cutting Tools—Catalog No. 55 describes Wendt-Sonis cutting tools. (Page 168)
A-11-157	Whitman & Barnes	Cutting Tools—Whitman & Barnes line described in Catalog 106. (Page 157)

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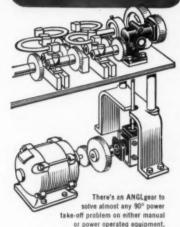
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In the application illustrated two ANGLgears provide a simple, compact, positive 90° drive. Because of its optional mounting features, ANGLgear was easy to design into this application.

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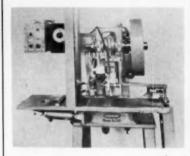
HILLSIDE 5, NEW JERSEY

INDICATE A-11-171-1 November 1956

Hot-Stamping Machine

Phenolic printed-circuit plates are marked in color with circuit identification or assembly numbers by this Model No. 9AS hot-stamping press which has a preset counter for any number up to 1000. The machine automatically counts, marks and ejects circuit plates.

Speed is 3600 marked plates per hour. Control is by means of a hand latch for



continuous or intermittent operation. The magazine has a friction drive and the ejector is of force feed type.

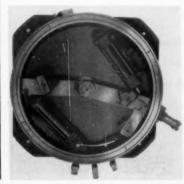
In operation, the plates to be marked are placed in a magazine, the counter set for that number and the hand latch release pressed. Marked plates are ejected into another magazine. The pneumatic feeding unit is electrically operated from the ram.

The Acromark Co., 607 Morrell St., Elizabeth, N. J. T-11-1711

Indexing Table

A 26-in. heavy-duty air-operated rotary indexing table, designated The Pitt. handles loads up to 500 lb. It is designed to avoid any chance of overindexing. An adjustable hydraulic control assures cushioned stops under all load conditions. A splash oiling system of lubricating permits all hardened moving parts to be fitted to tolerances providing indexing accuracy of \pm 0.0005.

Setup work is simplified by a double solenoid valve equipped with pushbut-





CHICOPEE, MASS.

INDICATE A-11-171-2

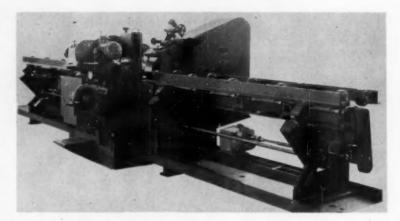
tons for rapid change-over from automatic to manual operation. Operating pressures range from 75 to 100 lb. Tables are available with from 6 to 18 stations.

Pitt Industries, Carnegie, Pa.

T-11-172

Centerless Grinder

Type 614 centerless grinding machine, designed to use abrasive belts as cutting and feeding media, will handle long bars and tubes up to 4-in. diameter using power-driven fixures. Belt speed is 3500 fpm. Grinding belt is 6 x 168 in.; the feed belt is 6 x 47 in. The contact wheel is 16-in. diam with 6-in. face.



For heavy stock removal requiring several passes, a traverse reversing device is used which permits grinding of the workpiece in both directions of traverse. This device, which may be operated manually or automatically, permits reverse of traverse direction so that as many passes as may be necessary can be obtained without rehandling the work.

Production Machine Co., Greenfield, Mass. T-11-1722

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Milling Machine

Overarm of this Pedersen Model VPF-2 milling machine is provided with a heavy size dovetail guide for clamping it to the column and to permit clamping of two arbor supports. It also is fitted with a holder for the coolant pipe.

The unit is designed to provide unusually sturdy construction and vibration-free operation.

Motor and gearbox for the feeds are built on the knee to avoid need for universal joints. To prevent breakage of





ORTH LOOKING INTO!

The Tool Engineer

the feed mechanism, the gearbox is provided with a special friction clutch which comes into operation in the case of sudden overloads or table collisions. There are 12 different feeds, and quick traverse in all three directions.

Distributed by Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y. T-11-1731

Counterbalance Cylinders for Punch Presses

These counterbalance cylinders, designated Model L, may be installed on any power press in any of four universal methods.

There is no ram drop or override. Punch press brake wear caused by excessive brake pressure is minimized. There is no ram backlash.

The Model "L" is available in 5, 6



and 8-in. bores with 16-in. stroke. These sizes may be modified to 8, 10, 12 or 14-in. strokes and are also available in strokes to 22 in. Bores of 10 and 12 in. are available with any mounting and any stroke from 8 through 22 by 2-in. increments.

Dayton Rogers Mfg. Co., 2824 Thirteenth Ave., S., Minneapolis 7, Minn. T-11-1732

Palm Button Valve

A leakproof, 122-Series, palm button valve, suitable for general applications which require a normally closed straighway or three-way hand-operated pilot valve, is designed for use in circuits where safety is of prime importance.

This valve can be provided with a tumbler type lock, enabling the valve to



Milford makes rivets from a wide variety of metals, alloys, platings and finishes!

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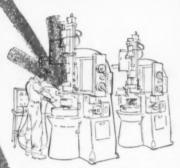
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be locked in either the open or closed

Low operating force and large diameter palm button serve to reduce operator fatigue. Although it is 1/4 NPT side ported, over-all height is only 23/8 in. The 3-way model has a nonpiped exhaust and both straightway and 3way have 1/4 in. diam flow capacity.

Ross Operating Valve Co., 120 E. Goldengate, Detroit, Mich. T-11-1741

Master Feed Fingers

Designed especially for use on multiple-spindle screw machines, these master feed fingers can be adjusted at the machine. The nose cap can be easily removed and tension of the finger loos-



ened or tightened with minimum of lost

Oil and wear-resistant synthetic rubber inserts grip and feed any bar stock without scratching or scoring.

This design is available for all types of multiple-spindle automatic bar ma-

Green Mfg. Co., 122 S. Prairie Ave., Rockton, Ill. T-11-1742

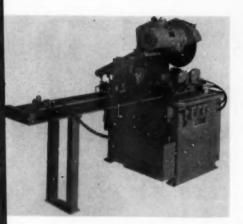
Cutoff Machine

Specifically designed for cutting ferrous metals, M-75 cutoff machine is equipped with fully automatic bar stock feed and power stroked head.

Speeds of 550 cuts per hour are maintained during production runs, with tolerances held to less than 0.005 in. Work is turned out with a milled-like finish and requires no further machining.

A wheel wear compensator adjusts for fast approach and a Hydro-check regulates speed of cutting, assuring accuracy throughout the wheel life.

The cutting head is engineered with



geared-in-head positive drive that delivers all the power to the cutting wheel. It will cut 11/2-in. solid rounds easily. Stone Machinery Co., Manlius, N. Y. T-11-1751

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Rotary Toggle Switch

Many circuits can be controlled with single-motion, mechanical actuation by this rotary toggle switch. Because it can handle a high electrical load, there is no need for relays and other electrical devices. It may be used for most industrial and airborne applications.

The four-pole, double-throw switch (designated 4TRI) is maintained in all three actuation positions: on-off-on. It



has 12 terminals. Other models are available with up to 24 terminals (8 poles).

The switch has an operating force of 9 in-lb max, a continuous capacity of 30 volts d-c, 20 amp resistive, 5 amp lamp or 12 amp inductive. At 115 volts a-c, 20 amp resistive; 4 amp lamp and 15 amp inductive.

Micro Switch, Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill. T-11-1752

Air-Powered Drill

Portable air-powered drill, with a positive mechanical feed attachment, is designed to hang by its nose to a jig or fixture to absorb the thrust and torque of drilling up to %-in. holes in hard materials. The tool, called the K-Matic drill, develops up to 1000 lb of thrust, and is used for drilling in aluminum alloys, titanium or heat-treated stainless and alloy steels.

Positive differential lead screw prevents plunging on breakthrough and helps minimize work hardening. Hole finish is often clean enough that there is no need for reaming. With standard bits and normal drilling conditions, the tool can drill holes within 0.001 to 0.003 in. oversize, and uniform to \pm 0.0007 in.



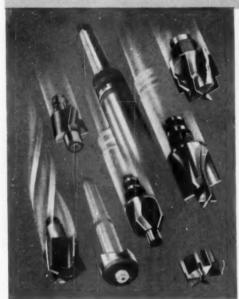
The lead screw permits uniform penetration through sandwich construction.

Forward and return stops are easily adjusted and compensate for drill grinds. The drill bit automatically rereturns at the end of each stroke. Both feed and return strokes are controlled by a single lever. An offset drill handle can be adjusted to any radial position in relation to the attachments.

The tool, designed to fit Keller 11A-2 and 11A-3 air drills, can also be used with any make or type of portable drill

WHAT Engineered by Eclipse Means to 2000 Companies

Since 1913 Eclipse has been consistently and efficiently serving many companies in widely diversified fields of production: automotive, farm implement, aircraft, household appliance and other metal fabrications. Each of these companies has found that "Engineered by Eclipse" is assurance of genuine quality in end cutting tools. Eclipse is represented in every major industrial market . . . for your convenience.



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- Inserted Blade Cutters
- **Multi-Diameters**
- **Back Spotfacers**

AND NOW Eclipse has added to its line



Ground from the solid for langer tool life and finer finishes.

Write for End Mill Cat. No. 56

COUNTERBORE COMPANY

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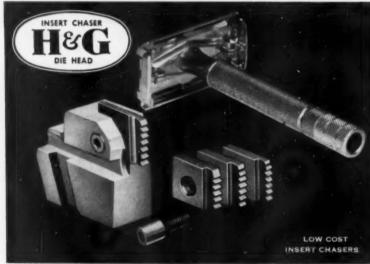


New Syntron Lapping-Polishing Machines are completely automatic. Driven by variable controlled electromagnets, they assure a positive, even polishing action on practically any part or sample where microscopic finishes are required. No expensive installation or grinding equipment required.

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Men would not accept either idea at first.

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THE EASTERN MACHINE SCREW CORPORATION, 27-47 Barclay St., New Haven, Conn. FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-176-2

by machining the attachment adapter to fit the drill.

It is less than 12 in. long and has a stroke length of $1\frac{1}{4}$ in. Chuck capacity is $\frac{3}{8}$ in. Feed ratios are 0.002 or 0.003 in. per revolution.

Keller Tool Div. of Gardner-Denver Co., Grand Haven, Mich. T-11-1761

Circular Graduating Unit

Circular graduating machine for machine tool dials and handwheels is simple to operate accurately. It will graduate straight or angled surfaces with



from 40 to 1000 graduations with many combinations of length or line.

Abrasive Machine Tool Co., East Providence, R. I. T-11-1762

Dry Powder Lubricant

An air-floated dry powder lubricant, called Dry-Lube, applied by squeezebottle method, provides unusual penetration, thoroughly covers and effects positive lubrication.

Almost white color, it will not soil hands or clothes.

Reardon Products, 2109 S. Adams St., Peoria, Ill. T-11-1763

Multispindle Drill Head

This automatic revolving and indexing multispindle drill head may be used with any vertical single-spindle drill press. The tool, called Jemco Arbo-2 will take two to seven tools at one time.



The Tool Engineer

All spindles are completely and quickly interchangeable. Ten independent speeds are available. All work spindles are provided with suitable Morse and Jacobs tapers, and with suitable drilling and tapping chucks. Special tapers may be obtained.

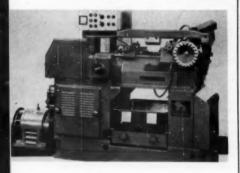
Workpieces are completely machined with single chucking. Speeds may be changed quickly. There is no need to reverse drill spindle during tapping operation. It has ½ to 9/16 in. tapping capacity, and 0 to 19/32 drilling capacity.

Jersey Mfg. Co., 455 Livingston St., Elizabeth, N. J. T-11-1771

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Copying Lathe

Automatic copying lathe made by Ludw. Loewe & Co. A. G., Berlin, Germany, incorporates qualities of a tracer lathe with those of a fully automatic cycling lathe. Slides, which operate independently, are mounted in the rear and in the front of the bed so that automatic turning operations can be carried out during one cycle. Many parts can be machined in a single setup. Model DA 150 may be used for chucking jobs



or for turning between centers. It is equally suitable for short runs or for long mass production runs on preformed parts.

Maximum workpiece length between centers is 10 in. The air-operated tail-stock is available with a spindle speed, synchronized with that of the main spindle. Main motor drive is separated from the machine to avoid vibration. Copying tolerances of 0.0008 in. can be maintained. Operation is by single lever centralized electrical control. There is micrometer adjustment for all slides and templates. Only one operator is required to load and unload a number of machines.

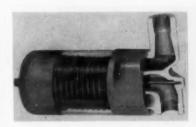
Distributed by Eric R. Bachmann Co., Inc., 27-11 41st Ave., Long Island City 1, N. Y. T-11-1772

Line Strainer

This line strainer, suitable for most liquids, produces a minimum pressure drop in the line, has large filtering area and includes a self-cleaning action in the filter element.

Filter element, composed of a number of wafer type filters, is designed so it restricts all filtering action to the underside of the units. The filter wafers, assembled on a stud extending through the central passage, are so constructed that they seat within each other and when fastened together form the central outlet passageway.

Entrance, filter clearance, center passageway and outlet of the unit are proportioned to provide optimum flow characteristics. The filter cloth is not bent in any way that might cause open-



ing variations or fatigue failures. The inexpensive wafer units may be replaced quickly and easily.

Capacities available are ¾ in.—5 gpm, ¾ in.—8 gpm, 1 in.—10 gpm, 1¼ in.—20 gpm. Filter element assemblies (without case) are available for sump applications up to 75 gpm.

Ripley Mfg. Co., Croswell, Mich. T-11-1773



Now, from Seibert, you can obtain tool control boards that are individually designed to suit your production requirements. Panels are subdivided into sections for each type of tool, and divisions are arranged as required with space for two sets of tools for each job. Tool panels and benches are available in 3, 6, 9 or 12-foot lengths. In addition, you can now obtain from Seibert pre-setting gages of all types and also optional equipment such as plastic cyclometer covers with locks, drawers, shelves, etc., to suit your specific needs.

INCREASES PRODUCTION EFFICIENCY

Tool Control Boards are a tested and proven method of increasing the efficiency of production machine tools. They provide a system of scheduling tool changes according to pre-determined efficiency standards. You cut down-time, insure longer tool life, reduce tool breakage, and lower scrap losses.

Write for Additional Data Get the complete story on new Seibert Control System. Specify circular T-10, or ask a Seibert Sales Engineer to survey your requirements.



SEIBERT & SONS, INC. CHENOA, ILLINOIS Quality MULTIPLE DRILL SPINDLES AND PRODUCTION TOOLS

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View of typical 9-section unit equipped with presetting gages. All units built under licensee patent £2679038.

PRODUCTION ADVANTAGES

Reduces down-time, provides an efficient system of programming tool changes.

programming tool changes.
Automatically controls machining operations, provides visual record of used life of each tool.
Assures more efficient use of tools, reduces breakage and scrap losses.
Provides storage and complete facilities for presenting tools at the machine.



Meeting the strict specifications of National Aircraft Standards, New York's Type A, B and C twist drills are specially designed for heavy duty drilling. Their stundy construction and precision points last longer and give greater production . . . Best of all, you pay no premium for these special types.

Another heavy duty drill is NEW YORK'S own Type 75 for deep drilling in 75ST aluminum. This high tempered, extremely abrasive metal can be a real headache — but not with NEW YORK drills. They bite in clean and easily, giving more holes, all perfectly round and on size.

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NEW YORK TWIST DRILL COMPANY, INC.

EASTERN HEADQUARTERS: 278 Lafayette Street, New York 12, N. Y. MIDWESTERN HEADQUARTERS: 30-A North Clinton Street, Chicago 6, III. abstracts of FOREIGN LITERATURE

By M. Kronenberg Consulting Engineer

Machining Aluminum

Range of recommended cutting speeds for machining aluminum varies as much as that for machining various types of steels, due to differences in physical properties and composition of the numerous grades of alumnium. J. Withhoff in an article in *Technische Mitteilungen Krupp*, Vol. 13 No. 5, indicates that cutting speeds up to 4500 fpm are recommended for roughing pure aluminum of about 30 to 40 Brinell with feeds in excess of 0.008 ipr as against only 150-fpm cutting speed when roughing pistons of aluminum with more than 17 percent silicon.

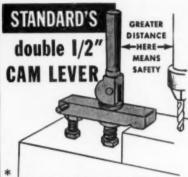
The author suggests adoption of six classes of aluminum for purposes of classification of machinability. Four classes would be based on Brinell Hardnes; namely 30-40, 50, 50-80 and over 80 Bhn. Aluminum pistons should be divided in two classes; namely, those with 11-13½ percent and those with more than 17 percent silicon.

The relationship between tool life and cutting speed can be expressed on double logarithmic paper by straight lines, having an inclination of negative 2.5. The author has found that the location of these straight lines for various types of aluminum is less significant than their inclination.

With regard to application of diamond tools for the machining of aluminum, the author claims that the surface finish on aluminum parts is the same for carbides and diamond tools except that diamonds produce a shiny surface which cannot be obtained with carbides.

Aluminum parts including silicon particles should be turned at low cutting speeds to preclude the possibility of tearing out these particles and damaging the surface finish. Cutting forces in the machining of aluminum are, of course, relatively low; the unit cutting forces vary between an average of about 140,000 psi at 0.004 ipr and about 70,000 psi at 0.032 inch feed. Chip breakers should be larger than those for

* CERTIFIED ...up to 3,450 lbs. clamping force



THE JAMES H. HERRON CO., (Laboratories for Testing, Analysis and Inspection) reports as follows: "With reference to the Double Cam Lever (500) and Eye-Bolt (500), we have conducted experiments to determine the amount of clamping force a man can exert with this device, lubricated. "Without the use of any auxiliary equipment, it was found that a man could exert up to 3,450 pounds, by bringing the lever to a position 90° with the Eye-Bolt."



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INDICATE A-11-178-2

The Tool Engineer

machining steel and cast iron; namely, about six to eight times the feed per revolution combined with a depth of 0.025 inch to 0.050 inch. Other phases discussed in the article are the lack of special machine tools for machining aluminum, tool design and considerations in grinding, milling, drilling and sawing of aluminum.

Chip Compression Research

Compression of the chip taking place during cutting operations has been used for many years as a means for analyzing machinability problems. It is also known in the United States by the term cutting ratio, representing the reciprocal of the chip compression. W. Leyensetter and H. L. Hall have recently extended the investigation of chip compression into the range of low cutting speeds. Their findings are published in Werkstatt und Betrieb, No. 8, 1956.

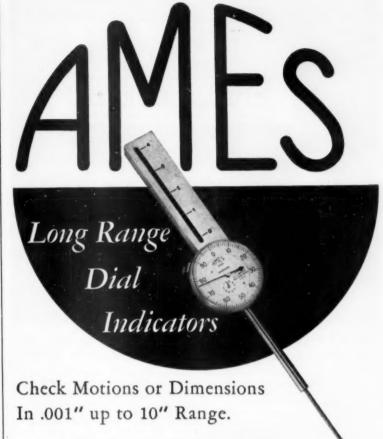
They believe important conclusions for machine shop practice can be drawn from chip compression measurements in operations at low cutting speeds such as thread cutting, broaching etc. A similarity exists between the deformation of the test specimen in tensile test investigations at various temperatures and the change in the chip compression at these temperatures. Conclusions can also be drawn from chip compression measurements on the surface finish that can be expected under given cutting conditions.

Copying Attachments

An article covering the present development of copying attachments in Europe appeared in the August issue of 1956 of Werkstatt und Betrieb under the authorship of Kurt Haeuser. He notes three categories of copying processes; namely, the mixed process, "Verbunddrehen," the trailing process and the simultaneous process. In the first, the template is attached to the rear of the lathe and the cross slide at the rear of the carriage is used for the copying operation. This often puts a heavy load on the "upside-down" turning tool, resulting in poor tool life. The author recommends use of front tool to reduce the cutting load at the rear tool by having it traveling slightly ahead of the rear tool. When the front tool is hand operated, life of the copying tool is usually greatly increased. A machine with such an arrangement is built by Hahn & Kolb.

The second method is the most common copying process, using either a duplex toolholder or two coupled cross slides in conjunction with one or two templates. In these cases the tools or cross slides operate in sequence.

The third method permits machining the same or different portions of the workpiece with the front and rear copy-



Ames Long Range Dial Indicators in a variety of models are made for quality control applications requiring close tolerance and inspection. For example, you can measure in .001", long slide travel, large cams, deep recesses or other dimensions requiring indicator spindle travel of up to 10".

In addition, Ames Long Range models have all the advantages that are built into Ames regular indicators:—dials of large diameter; easy-to-read, widely spaced graduations; movable dials; replaceable contacts. All Ames Long Range indicators have count hands to indicate revolutions of the indicator hand. Those with box covered, rack guide have a slot in the cover graduated to register each inch of spindle movement.

Write today, sending your problem in long range measuring. Ames will be glad to suggest a solution. Be sure to include drawings and specifications – your answer will be back faster if you do.



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Now! Closer gage block tolerances give you up to 75% longer wear life at no increase in price!

Ellstrom Standards are now produced and unconditionally guaranteed to specified millionths well within the following improved gage block tolerances:

"W" Working Accuracy Blocks: +.000008", -.000002" per inch of length, with flatness and parallelism held within .000006".

"I" Inspection Accuracy Blocks: +.000004", -.000002" per inch of length, with flat-ness and parallelism held within .000004".

In addition to providing finer accuracy at no increase in price, these Ellstrom Standards also give you up to 75% longer wear life. For, by reducing the allowable "minus" deviation, you get an additional guaranteed wear allowance of from 2 to 6 millionths of an inch, as compared to

common industry standards, before the blocks need be considered worn undersize. Ellstrom Standards are furnished in 28 basic sets of from 8 to 92 blocks in both rectangular and square styles. Individual blocks are also available in sizes ranging from .010" to and including 20.000" to Send for your particular needs. complete specifications and prices today!

Set No. 35-B: "W"-\$195.80: "I"-\$280.50



ELLSTROM STANDARDS DIVISION DEARBORN GAGE COMPANY leasuring in Millionths for Three Gene

REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE UNITED STATES AND CANADA



ing devices. It is, however, also possible to have them operate in sequence as in the second method. The simultaneous method can be used on external surfaces, on internal and external surfaces simultaneously, and for simultaneous roughing and finishing. This latter combination is, however, not always recommended due to the differences required in cutting speed and feed, which cannot be obtained when simultaneously copying the same surface. There are, however, cases where this method worked well. Cutting time is greatly reduced by simultaneous copying at several parts of a workpiece. Illustrations refer to operations on machines by Bondy, Switzerland: Liechti, Switzerland; Oerlikon, Switzerland; LeProgres Industriel, Belgium; and Neue Magadeburger Werkzeugmaschinenfabrik, West Germany.

High-Speed Hobbing

An article in THE TOOL ENGINEER, 1954, No. 6 by J. W. Rapp describing high-speed hobbing was the cause of an investigation to improve the cutting speeds of hobbers by H. A. Koop who reports his findings in Werkstattstechnik und Maschinenbau No. 7, 1956.

Hobbers have erratic tool loads at the cutting edges causing irregular wear and requiring relatively low cutting speeds. Some of the teeth of a hobber cut predominantly at the right-hand flank, others at the left-hand flank and others again at the OD. The chip cross sectional areas also vary considerably from tooth to tooth, depending on whether they have to do the roughing or the finishing of the teeth being cut.

Conditions have been improved by changing the relative position of tool and work step-by-step in order to bring cutting edges that are only little worn into the region of higher loads.

New hobbing machines are now equipped with automatic hobber shifting devices or can be equipped with them as an optional attachment. The rate of shifting can be accurately controlled and depends on pitch, angle of inclination, number of teeth and on whether the chip grooves are parallel to the axis or perpendicular to it.

As an improvement of the automatic shifting device, a new method has been developed abroad, the so-called "diagonal hobbing." The hobber is moved once over the entire length during the cutting operation and returns in rapid traverse and tangentially to its start position. In addition to a high accuracy of pitch produced, diagonal hobbing also permits an even wear of the cutter teeth, due to stepless shifting. The author gives formulas for setting the minimum step and also data for cutting speed and other pertinent items.











literature

For Free Booklets and Catalogs - Convenient Request Card on Page 169

Tool Steel

Illustrated Booklet 419 presents information on Bearcat general-purpose, air-hardening tool steel including facts on its uses, characteristics, tensile properties, instructions for working and heat treatment. Bethlehem Steel Co., Bethlehem, Pa.

L-11-1

Plastic Tooling

Eight-page publication, "The Marblette Digest of Plastic Tooling," provides concise summaries of existing applications of plastic tooling for metalforming, plastics forming and in foundry practice. Outlines applications, advantages, construction methods and handling suggestions. Marblette Corp., 37-31 Thirtieth St., Long Island City 1. N. Y.

L-11-2

Hot Spray

Informative 28-page booklet, "Why Hot Spray?" lists major benefits of hot spray applications of finishing materials, explains each benefit in detail and illustrates each with case histories. Other important points are well covered by question and answer section. The Spee-Flo Co., 720 Polk, Houston 2, Texas.

L-11-3

Positioning Systems

Bulletin No. 819 describes Inductosyn® linear and angular micro positioning systems, an electrical automatic machine tool control capable of automatically positioning carriage of a machine tool with a miximum linear error of 0.0001 in. or positioning a rotational member with maximum angular error of 5 sec of arc. Farrand Controls, Inc., 4401 Bronx Blvd., New York 70, N. Y.

Automatic Assembly

Bodine Case History Book gives quick-reference tooling and production details on 14 different types of work now being produced on company's basic machines with various combinations of standard tooling methods and units. Also presents information on new service which provides machines in four sizes with a range of matched and standardized spindles, feed units, indexing tables, etc. so user can develop own special equipment. The Bodine Corp., Bridgeport, Conn.

Inspection

Twelve-page brochure IPC-6-56 discusses principles of air-gaging with the column Precisionaire; describes and illustrates basic tooling for inspecting internal and external dimensions and conditions and types and sizes of adjustable air-gage tooling; shows single and multi-dimension gage applications. The Sheffield Corp., Div. 610, Dayton 1, Ohio.

L-11-6

Taps

Basic information on taps, their uses and descriptions covered in pocket-size, illustrated, 72-page "Tap Primer"; includes discussions of characteristics qualities and features of taps of various design and purpose plus a simple treatise on the science of tapping and explanation of tap and thread terminology. Threadwell Tap & Die Co., Greenfield, Mass.

L-11-7



ARMSTRONG-BLUM MFG, CO. • 5700 West Bloomingdale Avenue • Chicago 39, U.S.A. FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-181

Forming Equipment

Radial draw formers and contour stretch formers presented in 60-page catalog discussing their construction, operation, uses and advantages; illustrated with photos, drawings and diagrams and specification tables. The Cyril Bath Co., 32400 Aurora Rd., Solon, Ohio.

L-11-8

Fixture Clamps

Brochure describes and illustrates line of fixture clamps and details; specification table and detailed line drawing accompany each photo; photographic index in outside margin of each page provides quick reference aid; also includes full size tracing templates of fixture clamps. Monroe Engineering Products, Inc., 1515 Hurd Rd., Monroe, Mich.

L-11-9

Grinding

Up-to-date 222-page pocket size reference book, Form 781 "Handbook on Toolroom Grinding," offers complete information on toolroom grinding, carbide tools and cast alloy tools; includes pertinent data tables; well illustrated to show details of various points covered in text. Norton Co., Worcester 6, Mass.

L-11-10

Bed Type Milling

Extensively illustrated brochure includes close up views of important design features, tabulates specification data and describes construction and operation of company's Mill-M-Matic bed type milling unit with automatic electrical control. The Motch & Merryweather Machinery Co., Penton Bldg., Cleveland 13, Ohio.

L-11-11

Gage Components

"Gage Components for Process and Design Engineering" offers informative data on complete line illustrated by photos and dimensional drawings; loose leafed for user convenience, the catalog is sectionalized according to types of gages; set of tracing templates also included. Request only on company letterhead direct to A. G. Davis & Engineering Co., 21435 Dequindre Rd., Hazel Park, Mich.

Brakes and Clutches

Company products and services described in 36-page Bulletin 500-A; includes history, applications and design data on clutches, brakes, couplings, power take-offs, rotorseals, quick release valves and high-speed controls; includes tables and drawings of dimensions, torque ratings and other pertinent information for selection and installation. Fawick Airflex Div., Fawick Corp., 9919 Clinton Rd., Cleveland 11, Ohio.

L-11-12

Grinding Wheel Balancing

Automatic balancing for Cincinnati Filmatic, plain, roll and centerless grinding machines described in colorful 12-page brochure No. G-637-2; theory, sequence and details of equipment discussed and illustrated. The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

L-11-13

Crane Operation

Pocket-size 75-page manual on crane operation and hitching designed to instruct personnel in rules and practices required to assure safety; well illustrated with drawings and photos. Allistrated with drawings and photos. Allis-Chalmers Mfg. Co., Allis-Chalmers Safety Services Section, Box 512, Milwaukee 1, Wis.

L-11-14

Gages

Useful data and specifications for thread and plain cylindrical gages presented in 24-page catalog; well illustrated with photos as well as dimensional drawings. Godwin Gage Co., 27538 W. Seven Mile Rd., Detroit 19, Mich.

L-11-15

Milling Unit Comparison Guide

"Slide-Guide" offered to engineers, production men or purchasing agents responsible for selection of milling machines provides comparisons of 21 essential specifications to be considered; includes specifications for eight leading mills covering table sizes, speeds, feeds, capacity data and power specifications. The Greaves Machine Tool Div., J. A. Fay & Egan Co., 2101 Eastern Ave., Cincinnati 2, Ohio.



Radial Roller Bearings

Latest research data of Rollway engineers and current standards of Roller Bearing Engineers' committee combined in 56-page catalog-manual, "Precision Radial Roller Bearings," includes comprehensive tabular information on radial static and dynamic capacities; lists thrust capacities recently computed for complete line; presents application data and gives engineering formulae, graphs and drawings of representative installations. Request only on company letterhead direct to Rollway Bearing Co., Inc., 541 Seymour St., Syracuse, N. Y.

Silicones

Eight-page brochure features R/M silicone rubber products and silicone coated cloths; tells what the substance is, outlines its data and properties and discusses its advantages and limitations. Raybestos-Manhattan, Inc., Passaic, N. J.

L-11-16

Shock Control

Engineering data, performance curves, specification tables and details on design and use of plate form and multiplane mountings covered in 16-page illustrated Bulletin No. 702; useful as guide to selection of proper mounting for specific job; includes application and installation information. Lord Mfg. Co., 1635 W. Twelfth St., Erie, Pa.

L-11-17

Small Tools

Extensively illustrated 52-page Catalog 2720 describes line of small tools and accessories including cutting tools, end mills, chucks, collets, bushings and adapters, tracing styles, copy type, indexing work holder, rotary tables and chucks, indexing fixtures, milling heads, etc. Includes pertinent data for each type of tool and tabulates specifications. George Gorton Machine Co., Racine. Wis.

L-11-18

Tool Holder and Inserts

Eight-page Catalog 852C lists complete line of tool holders and triangular and square throwaway carbide inserts; includes details on styles, sizes and prices. Besly-Welles Corp., 852 Dearborn Ave., So. Beloit, Ill.

L-11-19

Granite Surface Plates

Illustrated 78-page technical manual describes manufacture of Microflat black granite surface plates and precision inspection accessories; explains how they are made; entire section devoted to geological sources and quarry operations. Collins Microflat Co., 2326 E. 8th St., Los Angeles 21, Calif.

L-11-20



NEVER LOADS THE WHEELS

K-7 solutions do not load work wheels, and this important advantage means (1) fewer dressings, (2) longer wheel life and (3) a true ground finish (rather than a burnished or smeared finish). In addition, with K-7 (because it does not load) you can often use a harder (1-2 grades) and finer (10-20 points) grit wheel, resulting in better work at lower cost.

Investigate K-7 for use in grinding all steels, cast and malleable irons, titanium, carbon, rubber, ceramics and plastics. (Not recommended for non-ferrous metals.) It is an all-chemical water soluble liquid concentrate, transparent and colorless in solution. It is non-foaming and runs absolutely flat under all conditions. Low pH (alkalinity) makes it easy on the skin. Send for details.

CONCENTRATION TEST KIT

With this pocket size Concentration Test Kit K.7 users can check the concentration of the solution right at the machine. Only takes a minute or two.



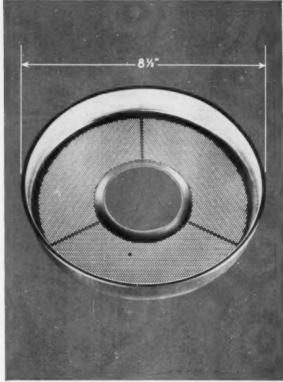


F. E. ANDERSON OIL COMPANY INC.

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WHICH DIE STEEL WOULD YOU USE

to be sure of getting 6,066 perfect holes in this die?

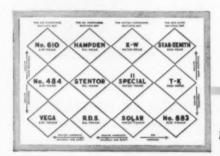
These tools are used in a 60-ton press to pierce 6,066 holes of .036" dia. in aluminum filter pans for a popular home appliance. The job demands "almost everything" from the die steel . . . good machinability and uniformity, minimum size change, extra safety in hardening and toughness to withstand heavy press loads.

The filter pans are 8½" in dia., and .025" thick. The 6,066 holes are perforated in three blows, as the die moves through three 120 degree indexing stations. Hundreds of machine hours are involved in drilling and taper reaming the tiny holes.

If the decision were up to you . . . on which die steel would you be willing to stake your reputation in view of this tough set of requirements?

In this Field Report from customer files, here are the amazing results: Working with Carpenter VEGA (AirTough) Die Steel, the company reports that not a single "hard spot" was encountered . . . all 6,066 holes are in the die as planned. The machining of VEGA was "considerably easier" than the machinery steel used for the stripper plate. What's more, there was no discernible change in size or shape after heat treatment . . . the die held perfectly!

You can count on good results from any Carpenter Matched Tool and Die Steel. Take the risk out of your tough tooling jobs. Call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor now for immediate delivery.



Carpenter

Matched Tool and Die Steels

The Carpenter Steel Company, 154 W. Bern St., Reading, Pa. Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

® U. S. Patent Office, The Carpenter Steel Co., Reading, Pa



Preparations to enter the electronic air cleaning field are being made by Minneapolis-Honeywell Regulator Co. Plans indicate that the company will develop and produce the equipment and begin marketing activities in the field early in 1957. Manufacturing operations will be carried out at the firm's plant at Wabash, Ind.

VVV

A research and development division devoted exclusively to instruments, controls, machines and systems for "autometrology" has been established by The Sheffield Corp. The new operation, combining machining, motion or memory with automatic measuring is aimed toward helping industry deal more efficiently and economically with current precision measurement and control problems.

expansions

The Warner & Swasey Co. is planning to spend approximately \$2,800,000 for construction of additional manufacturing space and acquisition of additional machinery and equipment. The expansion, which is scheduled for completion by late 1957, will increase the company's machine tool capacity by about 25 percent.

VVV

Fifth major 1956 expansion in company branches has been announced by Thor Power Tool Co. whose factory sales and service branch in Detroit has been moved to new and larger quarters at 14515 Puritan Ave.

V V V

General Electric's Medium Induction Motor Dept. has announced a \$2-million expansion in Schenectady, N.Y. for manufacturing and testing of "canned motor" and electromagnetic pumps for the atomic industry. According to the company announcement, the number of department employees engaged in this work "will almost triple" within the next 12 months.

Second step in a \$5-million expansion program is currently under way by Armour Research Foundation of Illinois Institute with the \$575,000 addition to its metals research building. Completion of the construction of this extension is expected by late spring 1957. In addition, the Institute plans to add \$175,000 worth of new research equipment.

V V V

Racine Hydraulics & Machinery, Inc. has purchased a new plant to provide an additional 25,000 sq ft of area. The new Plant No. 2 will contain complete production, engineering, marketing, sales and office facilities.

V V V

All-State Welding Alloys Co., Inc. has completed the fifth expansion of its White Plains, N. Y. center for research, development and manufacture of alloys and fluxes. The 1956 building program has added an estimated third to the company's capacity.

V V V

New district office of Niagara Machine and Tool Works has been established in Indianapolis, Ind. at 5226 N. Keystone Ave. Frank L. Kelsey is manager.

V V V

Increased stocking and shipping facilities, as well as a large operating display area, are provided for Durant Tool Supply Co. in its new general office and warehouse located at 1 Thurbers Ave., Providence, R. I.

new companies

Formation of Karp, Lesser & Co., Inc. has been announced by Daniel S. Karp and John Lesser, formerly chief executive officers of Karp Metal Products Co. The new firm will serve as engineering and management consultants to the precision sheet metal fabrication field and allied industries. Offices are located at 60 E. 42nd St., New York 17, N. Y.

A West Coast firm to distribute warehouse stocks of high-speed and tool steels has been established by Vanadium-Alloys Steel Co. in the Los Angeles district at Maywood, Calif. R. P. Stemmler has been named president of the new Vanadium-Pacific Steel Co.

VVV

H & H Machine Co., Inc. has been formed to specialize in fabrication of tubular metal products. Recently reorganized and incorporated, the new firm is successor to H & H Machine Co. founded in 1950 to engage in tool and die design and manufacture. The new organization, located in Norristown, Pa., is headed by Kenneth Howie, Sr. as president.

name changes

Godwin Gage Co. is the new name of the firm formerly identified as the Standard Thread Gage Co. According to the announcement, the name change not only would avoid confusion with other manufacturers selling under similar names but also would better reflect the full range of products made by the company. There are no changes in either personnel or policies of the firm.

V V V

Firm name of Die-Mold Engineering Co., El Monte, Calif has been changed to The Argyle Engineering Co.

new facilities

Boice Gages, Inc. has started construction of a new plant at Hyde Park, N. Y., which will permit present production to be tripled while providing space for still further expansion.

VVV

Industrial Tectonics, Inc. is building a new Western Div. plant in Compton, Calif. to manufacture precision antifriction bearings having special characteristics. The new plant, which will replace the Los Angeles plant that was acquired last year, will include complete manufacturing and office facilities.

V V V

Purchase of the Hathaway plant in Boston to house its Transistor Div. has been announced by Minneapolis-Honeywell Regulator Co. The three-story 250,000-sq ft structure will house engineering, production and sales facilities of the division now located in Minneapolis. Activities and administration will be integrated with those of Honeywell's Doelcam Div. also located in Bos-

ton, while production facilities for manufacture of the Doelcam Div.'s line of gyroscopes, synchro motors and other electro-mechanical servo components will also be consolidated in the new plant.

VVV

Joseph T. Ryerson & Son, Inc. has scheduled construction of a new steel service plant on a 14-acre tract near Indianapolis, Ind. The facility will include a 2-story office building as well as a 2-span warehouse with adequate floor space for stocking a comprehensive range of carbon, alloy and stainless steels.

At the same time, details of the company's Charlotte, N. C. steel service plant were revealed. It will be a similar facility to the Indianapolis plant, both of which are scheduled for completion late in 1957

V V V

A new \$3-million plant has been opened at Waltham, Mass. by Baldwin-Lima-Hamilton Corp. to house its entire Electronics and Instrumentation Div. under one roof. Component operations of this division, which will manufacture testing instruments, previously were carried on as Ruge deForest, Inc. of Cambridge, Mass., O. S. Peters Co. of Washington, D. C., Sonntag Scientific Corp. of Greenwich, Conn., and Testing Equipment Dept. of Eddystone Div. of Baldwin-Lima-Hamilton, Philadelphia. The three companies, purchased by Baldwin in 1955, 1954 and 1949 respec-

tively, and the Testing Equipment Dept., have coordinated their manufacturing for more than a year in spite of their geographical separation. Last year they were consolidated into the Electronics and Instrumentation Div.

VVV

Plans for a new plant for manufacture of fabricated carbon products have been announced by Union Carbide and Carbon Corp. Upon completion, the facility, located near Lawrenceburg, Tenn., will be operated by National Carbon Co., a division of the corporation. It will have a production capacity of 12-million lb. of carbon products, with adequate provision for future expansion.

VVV

Combined office facilities for the Gardner-Denver Co. and Keller Tool Div. have been completed at 12700 Capital Ave. in Oak Park, Mich. The new building will house general and sales offices of both companies, a warehouse, storage areas for small parts and a repair shop.

corporate changes

E. W. Bliss Co. has acquired from American Flexible Coupling Div. of Zurn Industries Inc., exclusive rights to manufacture and sale of the patented, fully-crowned tooth gear type coupling for rolling mill equipment, their allied auxiliaries and other manufacturing machinery. The coupling will be sold under the name of Amerigear-Bliss. American Flexible Coupling Div. of Zurn Industries will continue to manufacture and sell their regular and special line of Amerigear couplings for all other applications.

VVV

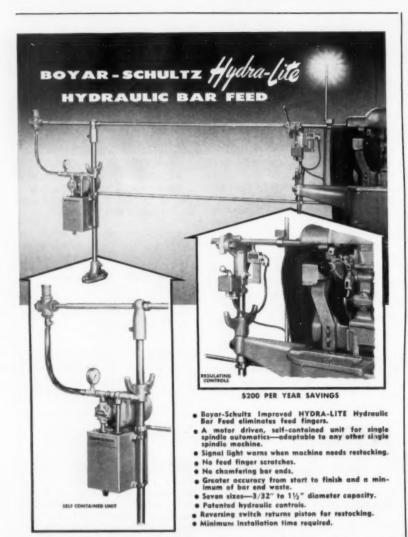
Through the recent acquisition of Western Design & Mfg. Corp., U. S. Industries, Inc. has entered the field of engineering, design and manufacture of aircraft and missile components and systems.

VVV

Announcement of the merger of Gemmer Mfg. Co. into Ross Gear and Tool Co., Inc. was recently made by John E. Jarrell, President of Ross Gear. The Gemmer plant will be operated as a division of Ross Gear.

VVV

Under a purchase agreement with Newport Steel Corp., Acme Steel Co. has taken possession of the property and assets of that former Merritt-Chapman & Scott subsidiary. As a wholly owned



BOYAR - SCHULTZ CORPORATION Dept. D-S, 2004 SOUTH 25TH AVENUE

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subsidiary of Acme Steel, Newport will be operated as an Illinois corporation under the name of Acme Newport Steel Co. The acquired firm will continue to produce its present line of products which will be augmented by additional steel specialties. Present management will continue to administer the business.

American Brake Shoe Co. recently announced that The Denison Engineering Co. had become a division of the company. Denison has been a wholly owned subsidiary since June 1955. No change in personnel is involved in the

American Optical Co. has purchased J. W. Fecker Inc. which now will be operated as a wholly-owned subsidiary. There will be no change in personnel. As part of the purchase, American Optical also acquired assets of Akeley Camera Co. which was taken over by Fecker last year.

H. K. Porter Co., Inc. has acquired business of West Virginia Steel and Mfg. Co. whose operations now will be combined with Porter's Connors Steel

Machinery, equipment and inventory of Kendrick Mfg. Co. have been purchased by Superior Brass Works, Inc. Superior will continue the manufacturing operations of that company as Kendrick Div. at the Kendrick plant for several months but will move operations to its own plant as soon as necessary alterations are completed.

Jones & Lamson Machine Co. has acquired the physical inventory, work in process, trade names, design and customer good will of Modern Tool Works of Rochester, N. Y. The purchasing firm plans to integrate the new line with its existing line of tools in the Thread Tool Div.

new services

Rahn Granite Surface Plate Co. has instituted a new service growing out of a method of reconditioning of worn granite surface plates to an "as new" condition. The technique restores both the surface accuracy and the appearance.

Scientific instrument users may participate in a service and repair plan recently developed by Chicago Ap-



ER SCREWDRIVERS ther Assembling Equipment

> Present Owners Report a SHARP GAIN in OUTPUT and a RISE in PROFITS!

easons why you, too, should benefit from greatly stepped-up, lower-cost production and the wider profit margin that naturally follows . . . These 2-way advantages of DPS Power Methods have been proved in over a quarter century of service to modern industry . . . If you are still using out-moded assembling methods, change now . . . Get the facts about the extensive DPS line. No

doubt we have a product that can be adapted to your requirements. Write today.



BARREL FEEDER



Modern Necessities Widely Adaptable

These versatile devices not only provide the feeding operations on Detroit Power Screwdrivers. but they are being widely used on today's many special highproduction machines.

5 SCREW-DRIVING MACHINES nch and Pedes

WHAT IS YOUR FEEDING AND ASSEMBLING PROBLEM? -ALSO SEND SAMPLE ASSEMBLY

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KBF2 BORING MILLING MACHINE

WITH AUTOMATIC SPINDLE POSITIONING CONTROLLED BY HAND POSITIONER OR PUNCHED CARD SYSTEM

Preselective automatic positioning anywhere within a 50" x 30" area.

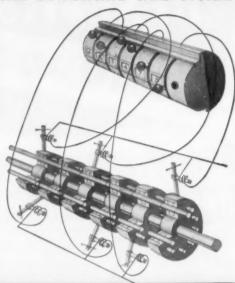
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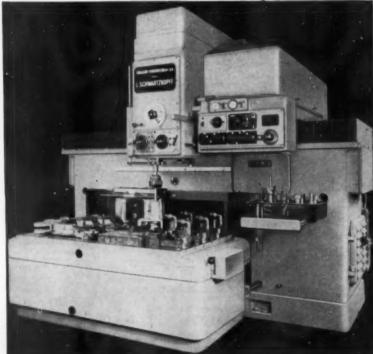
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trol completely eliminates possibility of human error...



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paratus Co. The program, which calls for regular preventative maintenance checks and emergency repairs, is similar in theory to the coverage purchased by many television set owners, and is designed to provide protection against breakdowns of highly complex apparatus which often controls large and elaborate production operations.

awards

A special Maintenance Award has been set up under sponsorship by Greer Hydraulics Inc. of Jamaica, N.Y. The annual award will be made for the best idea, proposal or design leading to solution of an aircraft maintenance problem. It may embrace a technique, design, device or instrumentation in the tear-down, build-up and/or testing of aircraft engines and accessories. Winner of the award will be presented with a plaque and an honorarium of \$500.

National prizes of \$1,000, \$750, \$400. \$200 and \$100 are being offered in each of two classes of competition in the 3rd Products Development Contest which is sponsored by the Steel Founders' Society of America every third year. Entries may be submitted in any of the areas of: original design, utility, theory, replacement or conversion, redesign, new items or market prospects, or actual case histories. Details are available from the society, 606 Terminal Tower, Cleveland.

training program

Cross Co. has launched an engineering school for machine designers in an effort to ease shortage of engineers and to help fill the company's particular needs in the future. Trainees are high school graduates whose selection tests indicated had an aptitude in that direction. The program will include a concentrated general learning of drafting techniques for 26 weeks and then 31/2 years of on-the-job training.

licensing

Prenco Products, Inc. of Hazel Park, Mich, has been granted an exclusive license to manufacture the Harmark line of foundry products in the United States by Harborough Construction Co., Ltd. of Market Harborough, England. Harborough is a leading British producer of binders, dressings and adhesives for use with the carbon dioxide hardening process for foundry C cores and molds. Initial quantities are expected to be available for delivery in the United States by October.



Versatile "lay away" clamped-on carbide circular form tool

Replacement costs and delays vanish with Crafts rugged, heat-treated alloy steel Tool Holder. Can be used over and over again for any number of different contours on B & S #00, #0, #2 machines.

Simply order our interchangeable carbide tips optically ground to your specifications. In stock for immediate delivery.



Send Today for FREE CATALOG "Complete Carbide Tooling for Automation". Describes Crafts' newest time and moneysaving contributions to the tooling field.



INDICATE A-11-189-1



Nov. 8-9. Steel Founders' Society of America. Technical and operating conference, Carter Hotel, Cleveland, Ohio. For details, contact society offices, 606 Terminal Tower, Cleveland 13, Ohio.

Nov. 8-9. Society of Automotive Engineers, Inc. National fuels and lubricants meeting, The Mayo, Tulsa, Okla. Get further details from society head-quarters, 21 W. 39th St., New York 18, N. Y.

Nov. 13-15. INVESTMENT CASTING IN-STITUTE. 4th annual meeting, Sheraton-Cadillac Hotel, Detroit, Mich. More facts may be obtained from institute office, 27 E. Monroe, Chicago 3, Ill.

Nov. 15-16. OPERATIONS RESEARCH SOCIETY OF AMERICA. 10th national meeting, Hotel Mark Hopkins, San Francisco, Calif. Write for details c/o Operations Research Office, Johns Hopkins University, 7100 Connecticut Ave., Chevy Chase 15, Md.

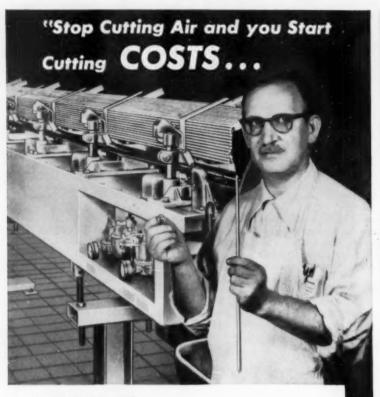
Nov. 25-30. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, Statler Hotel, New York, N. Y. More information is available from society, 29 W. 39th St., New York, N. Y.

Nov. 26-30. INTERNATIONAL AUTOMA-TION EXPOSITION, New York Trade Show Bldg., New York, N. Y. Complete information may be had from Richard Rimbach Associates, 845 Ridge Ave., Pittsburgh 12, Pa.

Nov. 27. American Institute of Consulting Engineers. Annual dinner, Waldorf Astoria Hotel, New York, N. Y. Contact institute office, 33 W. 39th St., New York 18, N. Y. for details.

Dec. 6-7. ILLINOIS INSTITUTE OF TECHNOLOGY. Cost Control Conference, IIT Commons Bldg., 3200 S. Wabash Ave., Chicago, Ill. Request more information from Institute, 35 W. 33rd St., Technology Center, Chicago 16, Ill.





Just equip with

LIPE Automatic MAGAZINE LOADING BAR FEED"

Says Foreman Billy Smathers*

"We put in two Lipe AML Bar Feeds as a test," explains Foreman Smathers. "At the same cutting speeds as our other screw machines, the AML-fed machines turned out the two pieces I hold in my hands, 78% faster for the small %" piece, and 108% faster for the 16" piece. That opened our eyes... but quick! Yet the reasons were perfectly obvious. The Lipe AML's fed stock without pausing. No cutting air. No repeat motion for feed-outs. No down-time for changing feed fingers, or for remnant disposal. The AML's geared our production to the steady pace of the clock...so many units of output per so many units of time. Overall, the gain was astonishing!"

WRITE OR WIRE for a FREE Lipe Sales Engineering estimate of production increases, savings and amortization time of Lipe AML Bar Feeds in your production layout.

Photographer's models and pseudonyms used to protect company identity and confidential Information.



Machine Tools . Heavy-Duty Automotive Clutches . Portakle Power Hack Saws

GOOD READING

ELI WHITNEY AND THE BIRTH OF AMERICAN TECHNOLOGY—by Constance McL. Green. Published by Little, Brown and Co., 34 Beacon St., Boston 6, Mass. Price \$3.50. 225 pages.

In 1792, when Eli Whitney graduated from Yale, the prospects of American Industry were far from bright. The nation was still in its frontier stage, and there was neither adequate labor force nor a body of artisans skilled in traditional crafts, such as had long existed in Europe. This lack of hands and shortage of skills compelled Americans to tinker, to look at the processes of production from fresh viewpoints and to contrive ways of sparing labor. Whitney was one of these tinkerers.

After perfecting the cotton gin, which brought him nothing but frustration and bitterness, he turned to the manufacture of guns for the government. Whitney concluded that the parts of a musket could be shaped by machine tools much more quickly than the skilled artisan could produce them by hand, and with such accuracy that their parts would be interchangeable.

It was his efforts and discoveries in this direction that led him to the principle of mass production.

This is a volume in The Library of American Biography, edited by Oscar Handlin.

INDUSTRIAL ENGINEERING HANDBOOK— Harold B. Maynard, Editor-in-Chief, Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price \$17.50, 1504 pages.

The function of industrial engineering has become increasingly important as industry moves to improve methods and reduce over-all manufacturing costs. Some companies recognize industrial engineering while others, not recognizing the function as such, never-

theless make use of some of the procedures used by industrial engineers.

This handbook contains a description of the best in practical industrial engineering practices and their application in industry. Methods, work measurement, time standards and wage payment are discussed, as well as control procedures, plant facilities and design and other aspects of industrial engineering.

Human and industrial relations of industrial engineering are stressed throughout the book.

CONTAINER SIZE AND PALLET PATTERN SELECTION CRITERIA FOR USE ON 40 x 48" PALLETS-by J. P. Akrep and S. Stambler, U. S. Navy Research and Development Facility, Available from OTS, U. S. Department of Commerce, Washington 25, D. C. Price \$3. 145 Dages.

Selection of pallets for conveying or storing materials plays an important role in the over-all efficiency of material handling operations. A great deal of time can be consumed loading and unloading pallets and usually experience is gained only by the trial and error method.

A new graphic method for quick selection of patterns for loading 20,000 sizes of containers on the 40 x 48" pallet has been devised by the navy. The method assembles data involved in comparative areas, dimensions and efficiencies, enabling improved area and cube utilization in warehousing and transportation of palletized loads.

Six master charts present 172 pallet patterns applicable to containers graduated in increments of 1/8" with lengths of 6 to 52" and widths of 5 to 43". Alternate container sizes also can be determined.

STANDARD COSTS FOR MANUFACTURING -2nd Ed.-by Stanley B. Henrici, Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price \$6, 336 pages.

Most tool engineers are familiar with the general idea of standard costs and realize that cost performances should be evaluated, not by reviewing actual costs alone, but by comparing them with a fixed measure—the standard cost—and discovering the reasons for deviation from that measure. Control comes when steps are taken to eliminate this deviation.

This book discusses new facts and methods on direct labor costs, capacity variances, standardization of operations, clerical procedures and a review of different types of cost systems. Also included are data for evaluating salaried positions, estimating costs for new orders, determining selling prices and selling management on the benefits of standard cost control programs.

His BALANCED Synclinal DESIGN



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request

In the plants of America's industrial giants, In the plants of America's industrial giants, as well as in smaller plants. Marvel Synchinal Filters are being installed on all types of hydraulic and other low pressure liquid circulating equipment. Marvels are chosen because of their excellent performance in protecting machines and increasing production by reducing down-time. They are proving again and again, their superiority in the one real test—ON THE JOB! The BAL-ANCED Synclinal Design of Marvel Filters provides that all-important balance between maximum ACTIVE filtering area and sufficient storage space for filtered out particles—therefore, longer periods of productive operation are attained in the absolute minimum of maintenance. They meet J.I.C.

Not only plant operators, but also, OVER 700 ORIGINAL EQUIPMENT MANUFAC-TURERS have recognized the superiority of Marvel Synclinal Filters and now install them as standard equipment.

Specify MARVEL SYNCLINAL FILTERS on New Equipment— Standardize with Marvel's on Existing Equipment

EASY MAINTENANCE

Both sump and line types may be easily dis-assembled, cleaned and reassembled by any workman on the spot, in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering appli-cations. No changes have been made in the basic, balanced synclinal design.

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available for sump or line installation in ca-pacities from 5 to 100 G.P.M. Greater capac-tities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

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Men at Work

Three major executive appointments at Gear Grinding Machine Co. and its subsidiaries involved William F. Wilson, who was named executive vicepresident of Gear Grinding; William J. Taylor, who became vice-president and general manager of Republic Gear Co.; and Fred F. Miller who was made vicepresident of Detroit Bevel Gear Co. Temporarily the presidency of Republic is being left open and Mr. Taylor will run that subsidiary through his new position. Mr. Wilson formerly was vicepresident in charge of engineering and manufacturing at the parent company. Mr. Taylor moves into Republic from Detroit Bevel where he was vice-president, administration. Mr. Miller has been vice-president of operations and director of engineering at Detroit Bevel.

During the recent annual meeting, James W. Vicary was elected president of Porcelain Enamel Institute to serve a two-year term. Mr. Vicary is president of Ervite Corp.

W. W. Gilmore was elected a vicepresident of Minneapolis-Honeywell Regulator Co. He is president of the company's Micro Switch division and will continue to hold that post.

Elmore Broadhurst has been named general nanager-Cyclops Div., of Universal-Cyclops Steel Corp. Formerly works manager of the Titusville, Pa., plant, he now assumes responsibility for the division's operating, administrative and technical phases.

A. King McCord was elected president of Westinghouse Air Brake Co. succeeding E. O. Boshell who resigned that office which he had held in addition to his present post of board chairman. Mr. McCord previously was president of the Oliver Corp.



gage divisions of the Pratt & Whitney
Co. He joined the company in 1940
and has held various supervisory positions in time study, routing, estimating
and planning departments of the division.

Andrew B. Huntington has been
named chief engineer of Ross Operating
Valve Co. He has been with Ross since

Earl R. Lewis, Jr. was made pro-

duction manager of the cutting tool and

Henry A. Lundy was recently elected vice-president of Hardinge Brothers,

1952 when he joined the firm as man-

ager of production engineering.

Square D Co. has made public the election of Wilbur H. Peter, Jr. as a vice-president of the company. He also became division manager of Electric Controller Div. on October 1. Previously works manager of the division, he succeeds Alvin C. Dyer who retired as vice-president and division manager, but who continues as a consultant to application of the company's electrical controls to steel mill and related heavy industry operations.

John A. Lindberg is manager of manufacturing operations for Mackintosh-Hemphill Div. of E. W. Bliss Co. Prior to joining the division in February, he was general foreman of Continental Can Co. and chief metallurgist for Struthers Wells Corp.



Appointment of G. E. Hutchinson to the recently created position of manager of quality control has been announced by Rem-Cru Titanium, Inc. Mr. Hutchinson, who was a member of the original research team which helped to develop titanium beginning in 1947, has been assistant sales manager of the company.

Several appointments have been revealed by Norton Co. following creation of three new divisions. Announcement was made by John Jeppson, vice-president who was made general manager of the abrasive division and director of manufacturing. Duane E. Webster was named assistant to the director of manufacturing and will continue as manager of diamond products and as chairman of the cost reduction and suggestion committees and as secretary of the technical products committee. Frank G. Gifford, who has been manager of wheels plants, was named works manager of the abrasive division. Previously manager of abrasive and bond plants, David Reid, Jr. is now factory manager. Harold E. White, who was production engineer for abrasive and bonds, is now assistant manager of crushing plants.

E. J. Formhals is new general manager of the Canadian operations of Progressive Welder, Canada Ltd. He brings to this position an extensive background in management, engineering, manufacturing and international sales in Canada and the U. S.





Alexander H. d'Arcambal (left) retires Nov. I as president and general manager of Pratt & Whitney Co., Inc., but will remain active in a consulting capacity and as honorary board chairman.

Edward P. Gillane (right) executive vice-president and a director of P&W, becomes its new president and board chairman. Mr. d'Arcambal is an ASTE past president. Both men belong to the Society's Hartford chapter.



Lunkenheimer Co. has revealed appointment of **Jack P. Anderson** to the post of chief industrial engineer. Prior to joining the company he was associated with the O. A. Sutton Corp. as plant industrial engineer. John P. Beal, Jr. former assistant works manager of the Titusville, Pa. plant of Universal-Cyclops Steel Corp., is now production manager of the Cyclops Div. responsible for operation and production planning functions. Appointment of Richard R, Kesti as chief engineer of both Valvair Corp. and Sinclair-Collins Valve Co. was recently announced. Mr. Kesti who formerly was group engineer in charge of missile valve and control component design and development for Chrysler Corp., now heads the general engineering divisions of Valvair and Sinclair-Collins.

Hank Bryk has joined Alloy Precision Castings Co. as special assistant to the executive vice-president. He will be in charge of the company's lost wax division and also will be concerned with special development and production problems.

Alfred D. Stevens has been named assistant general manager of Willey's Carbide Tool Co. and will be responsible for the company's newly expanded carbide metal manufacturing division. He formerly was quality control manager of Kennametal, Inc.

Jay B. Srybnik has been elected to the vice-presidency of S & S Machinery Co. He also will continue in his present capacity as chief of the firm's rental program.

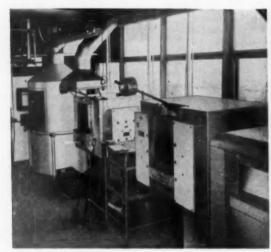
Thomas H. Pattison was recently made manager of the Pittsburgh plant of E. W. Bliss Co.'s Mackintosh-Hemphill Div. A veteran of 37 years with the division, he has been general superintendent of the Garrison Works since 1954

H. W. Loud Machine Works, Inc. has announced appointment of Nicholas M. Esposito to fill the newly created post of production manager. Mr. Esposito takes more than 21 years' production experience with Axelson Mfg. Co. to his new position.

New manager of the tabletting division of F. J. Stokes Corp. is **George Karian.** Specialist in sales of powder metal and industrial compacting presses for the past two years, he now will supervise all product design, sales and customer service activities.

Hugh D. Connell is now manager of the project engineering department of Acme Steel Co. Since 1954 he has been a project engineer in the New Products and Improvement Div.

The Barden Corp. has made public the elevation of **Harold H. Gillespie** to the office of vice-president and assistant general manager and of **Emil J. Karkut** to the post of vice-president and factory manager.









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A TRANSISTOR MAGNETIC power supply, small enough to fit in the palm of a hand, is designed to replace small vibrators, inverters, or dynamotors. It measures 2 x 2½ x 3 in. and weighs 1½ lb. The unit.

called Hycon-Verter, is being produced in limited quantities for specific operations.

Produce Miniature Power Supply

has a 24-v d-c input and provides outputs of 115 v, 400 cycle ac, and 150-v dc with a 25-watt load rating.

The instrument, which has no moving parts, supplies a-c power for gyroscopes, servomotors, and magnetic amplifiers; and high voltage dc for mobile applications and allied electronic equipment.

Efficiencies of as much as 90 percent are claimed for the unit, minimizing heat dissipation problems.

Because of its hermetic seal, it has explosion-proof characteristics and almost total absence of radio and acoustic noises.

Hycon-Verter units operating in the range from 20 watts to one kilowatt are contemplated by the company.

Spinning, throbbing, internal movements of an engine while it is running have been recorded in motion pictures by General Electric-Detroit Arsenal engineering team. The job involved taking X-ray pictures

through the steel housing, and visually stopping with a camera the high-speed motion.

Through the new technique, called stroboradiography, slow-motion X-ray movies and still pictures of pistons, cams and other moving parts have enabled engineers to scrutinize complete cycles of engine operation for faulty performance or wear.

Designers thus are given a glimpse inside a completed machine operating at normal speed under load conditions. Improved, lightweight designs, and perhaps important basic design changes could result from the X-ray motion studies.

The special stroboradiographic equip-

ment was developed by GE for use with its high-energy industrial X-ray betatron, operating at 5 to 15 million volts. The company's laboratory in Schenectady, N. Y., developed the equipment in cooperation with Detroit Arsenal and the G-E X-ray Dept. in Milwaukee.

Prior to this development, single-shot

exposures of moving objects have been made with low-energy equipment, but quality of the radiographs suffered when the object was composed of heavy parts of varying thickness.

The new process involves taking thousands of short exposures accurately synchronized with the moving part. With an exposure time of 10 to 15 millionths of a second, it is possible to radiograph an engine turning at several thousand rum.

Raymond A. Pulk, chief of the Detroit Arsenal's Materials Laboratory, conceived the idea of adapting the betatron to this concept. He indicated hope that individual shortcomings of a newly designed engine can be corrected by stroboradiographically examining the engine while it is running under load, thus showing up any components that might not be functioning correctly.





Gage unit components—for holding, adjusting and protecting dial indicators in special gage designs.



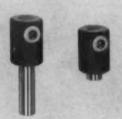
Gage blanks for large diameter countersink gages.



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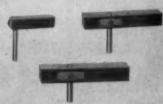
Depth gage bar and pin components. 1350 model sizes available from stock.



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Gage body and pin components for built-up gages. A new concept in gage designing.



Bar type flush pin gage blanks. 46 model sizes available from stock.

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Now available — a complete line of gage components for application in designing special gages. Wide selection of types and sizes available from stock.

Davis gage components eliminate designing, detailing and building many details of special gage designs. Both design time and special gage build costs are substantially reduced.

New 136 page catalog #9 with tracing templates now available to gage process and design engineers. Send for your copy today.

Gage component application in special design demonstrated to process and design engineering personnel by special appointment. Write for particulars.



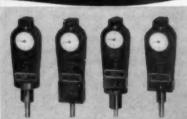
Davis mobile demonstrator.

A. G. DAVIS GAGE & ENG. CO. 21435 DEQUINDRE RD. • HAZEL PARK, MICHIGAN

World's leading manufacturer of gage components for special flush pin and indicator type gages.



Long series bar type flush pin gage blanks. 78 model sizes available from stock.



Gage component assemblies. Specified according to design needs.

automatic transfer in presswork

- speeds production
- improves safety
- cuts handling costs

By W. D. Berry

Electrical Engineer Danly Machine Specialties Inc. Chicago, Ill.

A UTOMATIC HANDLING DEVICES such as press loaders, unloaders, conveyors, shuttles and similar equipment, make stamping operations today contrast sharply with those of a few years ago. Now parts are moved into or out of stamping and welding presses, transferred automatically from press to press, and finally the finished part is loaded on a stock truck or conveyor.

In 1936, the production line for a floor pan included two large stamping presses to perform the forming operations. Blanks in bundles of 200 sheets were piled on horses in front of the first press. Two operators separated the top sheet and placed it in the die. After the panel was drawn, two operators at the back of the press reached in and pried the panel loose, pulled it out, placed it on a pipe slide and pushed it to the second press.

In this operation, much the same cycle was repeated except that four men were assigned to remove specific pieces of scrap so the next panel could be loaded. After 50 panels had been completed, the line stopped until the formed parts could be removed.

Lubrication of the draw operations was accomplished by two additional operators in front of each press. They used a mop and a 5 gallon bucket of drawing compound. Production was about 150 pieces per hour and ten operators were required.

In today's modern plant, the pile of blanks is loaded mechanically. If drawing compound is required, it is applied in measured amounts by properly located spray heads.

At the proper point in the press stroke, the loader receives a signal and pushes the sheet into the die. The loader will not move, however, unless there is a sheet in position for loading. The unloading device also receives a signal to unload the drawn panel and must remove the panel before a new sheet can be loaded.

Much the same cycle is followed in the second and third presses, except that, after the third operation the completed panel is removed onto a conveyor which loads it to a truck. Scrap produced in the second press falls free from the die into chutes which carry it to the basement where it is automatically collected and baled. One operator is stationed at the beginning and another at the end of the line to supervise the machines. Production rates are high, probably around 600 per hour. Limiting factor is the speed of the draw press.

Many press lines today are becoming

completely automatic in handling parts in this fashion, Fig. 1.

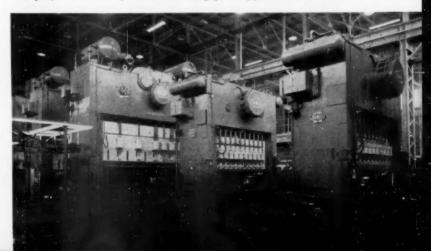
ech Dinests

Another type of automation in press lines is exemplified by the transfer press. In this system, a single press mounts all of the dies required to make a particular part. They are positioned side by side in proper operational order. A mechanically driven transfer mechanism moves the workpiece from one die to the next with each successive stroke.

In operation, a blank is automatically placed on the press loading station. After the press makes a work stroke, and as it begins its return stroke, the transfer mechanism moves each blank forward to the next station where they are located in the position for the next work stroke. Thus, at each stroke of the press, one blank is fed in and one finished piece ejected, Fig. 2.

Production speed of the press is high. Since the transfer mechanism is automatic, it never gets out of time with the slide to cause malfunctioning or smashups. No complicated interlocking is required. When on a run, the press operates continuously.

Fig. 1. Line of four transfer feed presses at Sterling Plant of Ford Motor Company. Automatic system for handling parts appears at left.





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Write for Bulletin 161-54 showing applications, models, specifications.

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technical digests

One limitation of this type of press is the size of parts that can be handled. So far, no body builder has adapted it to floor pan operations since cost would be high.

Advantage of Automatic Press Lines

A very important advantage of the automatic press line is the safety it affords. Guards such as screens, rails, gates, etc., keep employees away from danger zones while the line is in operation. Portions of guards removed for access to the equipment are equipped with switches that stop the line when removed, and prevent it from operating until the guard is again in place. Emergency stop buttons are located at critical points.

Since a well run plant is a clean plant, this also contributes to safety.

In early days of mechanization devices were, in some cases, called "gadgets." Some were crude but worked and proved the principles of automatic handling. Modern devices operate day after day without trouble. It is important, of course, that limit switches, relays, air valves, cylinders, etc. are the best that can be obtained for the service and are properly applied. More limit switches fail because of improper installation than because of overwork. The greatest cause of failure is forcing the switch arm beyond its limit of overtravel.

While the choice of drives for automation devices should be suited to plant conditions, hydraulic devices are sometimes found too slow, and in addition, present maintenance problems due to a tendency to develop leaks. Many plants use air to operate all loading and unloading devices and shuttles.

The possibility of using a mechanical drive taken directly from the press, unfortunately has not been thoroughly explored. It is a positive drive and where it can be used, will give a good account of itself. In designing automation equipment for a line of presses, it is important that various sections be portable so that the area in front and behind a press can be cleared for die change or service. Most modern presses are equipped with mechanically driven rotary cam limit switches for automation circuits. These can be easily adjusted to operate at any point in the press cycle and will retain accuracy of setting. Other operations are usually controlled by standard limit switches or sometimes photo cells.

Each device should have a tryout circuit to allow maintenance to check operation without exposing personnel



Fig. 2. Transfer feed press used in stamping automotive chassis parts, combines operations of six individual presses and eliminates manual handling.

to dangers of moving parts or affecting other devices in the line. Control circuits should be arranged so that if the line is stopped, restarting will pick up and continue the cycle from that point.

Justification for use of automation or mechanized devices is strictly on an economic basis. Regardless of cost, it must be shown that a device will pay for itself, in order for it to be built and used.

From a paper given at the 1956 On-Campus Conference sponsored by ASTE at Purdue University.

Human Management of Engineers

By H. M. Miller, Jr.

Personnel Div., Engineering Dept. E. I. du Pont de Nemours & Co., Inc. Wilmington, Del.

The story of the management of engineers is the story of management. It is in no way debasing to engineers to treat them as humans first. The fact that engineers are professional men makes them more sensitive to the strengths and shortcomings of management. For the same reason, they are much more apt to recognize that the true function of management is to achieve the goals of the organization by enhancing individual productivity. In short, when we do a better job of managing, our engineers will do a better job of engineering.

Too often we think of an engineer as a member of a group, often a large group, rather than as an individual professional employee. We fail to realize that he may think of himself in the same way, and that the group identification may tend to deprive him of the personal satisfactions he would have as a lone

professional worker. The struggle of engineers for true professional stature has increased the complexity of this problem. Indeed, at du Pont, our major concern is to see that these personal satisfactions are met and that each individual engineer receives proper recognition for his personal and technical contributions to the achievement of group goals.

Within the generally accepted limits of scientific management, a large part of productive supervision lies in the area of good judgment, personal concern and sound moral values. Where basic scientific management principles are established in an organization, tremendous improvement in the quality of supervision can be obtained by sufficiently emphasizing responsibility for the solution of supervisory problems. Skill can be effective only in the company of supervisory and personal integrity. With

FOR AVAILABILITY OF COMPLETE PAPERS WRITE THE HEADQUARTERS OFFICE OF THE SOCIETY NOTED AT THE END OF EACH ABSTRACT.

these qualities and a reasonably high degree of intellectual and social intelligence present, additional skills in supervision may be developed.

The most important element in the improvement of supervision is the desire to supervise well. This desire must be encouraged by the entire line organization giving close attention to supervisory problems, taking the time to coach as each opportunity occurs, and by giving sufficient top management emphasis to the necessity for high quality supervision at each level of the organization. Engineers placed in supervisory positions can supervise, and supervise well, if they want to deeply enough.

From a paper given at the ASME Fall Meeting of The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

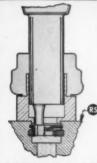
Electroplating Promises to Extend Titanium Applications

By Connie L. Stanley and Abner Brenner

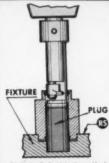
National Bureau of Standards Washington, D. C.

Extensive development work has been done on titanium in recent years to discover the metal's potential uses. It has two shortcomings, particularly, that limit engineering applications: When rubbed against another metal, it tends

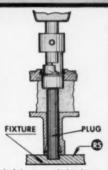
Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



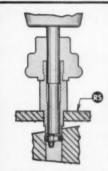
A) Cuts two grooves of different depths and widths in one single operation from same reference surface.



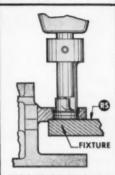
B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.



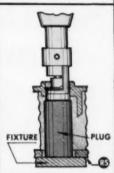
C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks, on reference surface. Then workpiece is reversed and tool banks on plug.



D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.



E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.



F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

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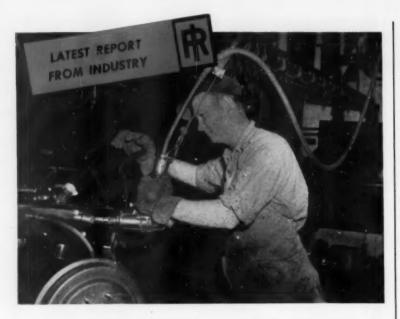
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November 1956



New I-R Torque Control Impactools prove value on auto assembly line

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to gall or seize, and it is not resistant to oxidation at elevated temperature. The simplest way in which to overcome these two shortcomings is to coat the metal with hard, oxidation resistant materials such as chromium or nickel.

Electrodeposition of adherent coatings on titanium has proved difficult. Deposits by conventional procedures either exfoliate during the plating operation or are easily detached with the fingers. The cause of poor adhesion is commonly attributed to the presence of an oxide film, similar to that which prevents adhesion of coatings to other passive metals, such as chromium and aluminum.

Based on this concept, a number of studies have been made to improve adhesion of plated coatings to titanium by removing the oxide film with various acid etches or anodic treatments prior to plating.

This paper describes methods of preparing titanium surfaces so as to provide adherence of chromium and copper coatings and evaluates degree of adhesion obtained with variations in the procedures. The most effective procedure developed vielded moderately adherent coatings of chromium as deposited but subsequent heat treatment of the plated specimen yielded an excellent degree of adhesion. Copper plating vielded coatings which were adherent only after heat treatment. These pretreatments and subsequent heat treatments were rather critical. As a result of these findings, further development work should be encouraged in this very promising field.

From a paper presented at the Annual Convention of the American Electroplater's Society, Home address 445 Broad Street, Newark 2 N. J.

How Motion Studies Can Improve Tooling

By Irving H. Norton Industrial Engineer Wallace Barnes Co., Div. Associated Spring Corp. Bristol, Conn.

To completely engineer a production operation, it is necessary to design with full knowledge of results that will be obtained. Engineering consists of both creating and evaluating. To create an idea is synonymous with designing, but if there is no tangible way to measure the design, the engineering is incomplete.

Motion studies and the standard data resulting can aid engineering, including

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place layout and tool design. How the tool design helps or hinders an operator, and by how much, should be carefully worked out in advance.

To explain, consider a press equipped with a swing guard that moves six in.hes out from the center of the die, Fig. 1. This means the operator must move her hand six inches out of the die to be clear of the guard. Assume the

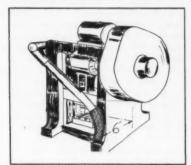
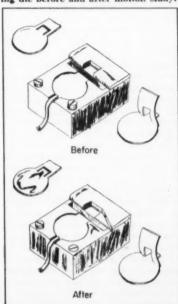


Fig. 1. Press setup with swing guard.

standard on this operation is 1000 pieces per hour. Now what will happen if the guard is moved so it is only three inches from the center of the die? This reduces the move-in to three inches, the reach-out to three inches, while the foot trip would be the same. The element time is now reduced and a 7 percent increase in production is secured.

From this example, it is evident that the effect of the guard on the production standard can be determined before

Fig. 2. Sketch of blanking and forming die before and after motion study.



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funds are spent on equipment. By knowing what percent the standard can be increased or decreased, funds can be applied to evaluate the work of a change. Thus, it is easy to compute and decide on a program of improvement.

In tool design, similar improvements can be secured. For example, the die shown in Fig. 2, yielded a production standard of 1740 pieces. At this rate of production, the positioning element of putting the part on the die was 17 percent of the total standard. By a simple change of the tool, grinding down one corner and setting one screw flush, the tolerances of initial engagement were loosened to remove the positioning element. As a result an increase of pro-

duction of 17 percent was secured.

If the tool designer had been trained to be aware of handling problems and motion patterns necessary to work with his tool, this gain could have been secured initially. Greater output and increased efficiency can be secured by building into the tool the easiest motion pattern. Standards will be higher, work easier, and fewer upsetting and time consuming changes need to be made.

From these examples, it is evident the advantage of predetermining results of a design or proposed change. Such measurements of human motion have brought industrial engineering into the field of science. It has given the industrial engineer the right to be called a professional in every sense of the word.

From a paper given at the 1956 Providence S.A.M.-M.T.M. Conference, Brown University, Society for Advancement of Management, 74 Fifth Ave., New York, N. Y.

How to Stimulate Interest in Technical Societies

By J. S. Alford

Designing Engineer Jet Engine Department, G.E. Evendale, Ohio

Being professional workers, engineers must bear responsibility for their own development. One of the most effective avenues for professional development—the technical society—relies mainly on engineers for its support. At the same time, industry must recognize its obligation to provide the engineer with opportunities and encouragement to participate in technical society work.

In decentralized organizations, engineers tend to find themselves concentrating on specialized problems. A good technical society breaks down barriers of specialization and brings members a better understanding of each other's problems.

To promote participation in technical society work, efforts should be made to:

- Create an encouraging climate and an atmosphere of enthusiasm.
- Promote individual activity among the members.
- Assist engineers in preparing papers and performing committee work.
- Publish information and keep suitable records.

Some progressive companies maintain staff consultants in matters of professional relations. As part of their responsibilities, they work not only with engineering managers to stimulate interest in technical societies, but directly with the societies themselves.

Several policies contribute to an atmosphere of enthusiasm for technical societies. For instance, the engineer's employers can pay his expenses at national meetings—expenses that can be burdensome for the individual who must travel far. Further, a company can sponsor memberships in certain societies and have a policy of publicizing society information.

By attending meetings himself, an engineering manager can most effectively encourage engineers to go to technical society meetings. Lip service is not enough. The manager should be present, greet young engineers, introduce them—nothing is more discouraging than to go to a dinner and speech and sit unnoticed—and perhaps even make up a party to leave from the office together. Most societies require a sponsor for the new member; senior engineers should offer to sponsor anyone interested.

Sometimes recent graduates need



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helping hands to bridge the gap between college and professional. The technical society can help close this gap, but the graduate's lack of experience sometimes prevents him from appreciating it.

Companies Can Help

Help is essential in preparation and presentation of papers. First, the engineer must have permission because the paper often relates to departmental business. The engineer can also be assisted in preparing the paper with secretarial help to type it, drafting help to make slides and even in preprinting the paper.

Publicity in company publications is also a help. An engineer cannot join a technical society or attend a meeting unless he knows about it.

Displays of literature and application blanks are also used in Evendale for this purpose. Personnel development activities of the plant provide informa-



Technical societies afford members an opportunity for broadening their professional background.

tion on awards and honors. Recognizing that many engineers find such awards real incentives, these are publicized and the recipients announced in the plant newspaper.

Thus an effective program for stimulating interest in technical society work must provide a favorable climate for the societies, encourage individual participation, arrange for adequate assistance and publicize the story.

From a report in the May-July General Electric Review. Published by permission.

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Management of Automation

By James R. Bright

Special Lecturer Harvard University Graduate School of Business Admin. Cambridge, Mass.

Many union people, engineers and others, say the motive of automation is to get rid of labor. It is true there is a reduction of labor content per unit product. However, there is a distinction between eliminating labor and raising productivity per man hour. In 9 out of 13 plants surveyed, the latter occurred rather than the former.

Management has been too shortsighted in assuming reduction of labor content is the principal benefit or the only one in many cases. Quality is also a major motive. An example is a feed mill which went into automation to reduce contamination in poultry feed by bulk handling instead of handling in bags.

Reduction in lead time is another important factor. An oil refinery cut this from 4 days to 5 hours. A fertilizer plant cut lead time from 10 hours to 2 hours.

Other motives are product redesign, improved safety, improved working conditions and reduction of in-process inventory. In most cases, however, automation means a loss of flexibility.

Cost May Be Less

Another cliché is that automation must cost more. An effect of automation is to pull a plant into a smaller building and less space. Where this is done to a great enough degree, even though the cost is higher per pound of machinery, the number of pounds is reduced so much that there is a good chance of getting the automatic plant for the same money as the conventional plant or even less.

Another cliché is that automation means greater maintenance problems and high maintenance costs. This is not necessarily so. Maintenance is often proportionate to novelty and uniqueness, not to how automatic it is. Also, breakin period is frequently confused with normal maintenance experience.

Another area of confusion is the impact of automation on labor. One of the phobias is that people may become unemployable because they must be highly educated to hold a job. The suspicion is that automation is making people more employable by downgrading requirements for a job rather than upgrading

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them, as so often is assumed.

As the machines become more automatic, less human contribution is needed from the operators. The machines take over the skill requirements.

Other impacts of automation are on supervision—the need for fast reaction. When a plant makes things fast, supervision must act quickly to prevent it going out of control.

The greatest impact is on the sales department. Automation is going to change the traditional sales relationships. Now the sales department will be faced by the machine just as surely as any worker

From a paper given at the 1956 American Ma-terial Handling Society Meeting, Cleveland, Ohio, The Material Handling Institute, Inc., One Gateway Center, Pittsburgh 22, Pa.

Ultrasonic Impact Grinding

By Patrick J. Duran

Application Engineer Raytheon Mfg. Co. Waltham, Mass.

It has long been known-probably by our cavemen ancestors-that power transferred through a metal punch with a soft tool tip to a hard abrasive can make cavities in materials that are harder than the tool tip. The modern application of this old idea is known as ultrasonic impact grinding. This new process makes possible such things as sizing shaped wire-drawing dies in carbide in 15 minutes, cutting a carbide stamp 0.025 inch deep in two minutes, and sinking a complete blanking die or intricate shape in hardened tool steel to a tolerance of 0.0002 inch in 45 minutes. Other applications include cutting holes in ceramics, dicing germanium diodes and duplicating delicately engraved patterns in glass or precious stones.

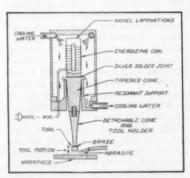


Fig. 1. Cross section of transducer.

In ultrasonic impact grinding, an electromechanical transducer is used to convert alternating current into mechanical motion. This alternating current is supplied by a driver unit at a frequency above 16,000 cycles per second. The vibrations of the transducer are amplified and transmitted by a shaped tool cone onto which is fastened a cutting tool. The cutting tool vibrates in a plane which is always parallel to the axis of the tool cone. Details of the transducertool system are shown in Fig. 1.

In operation, an abrasive slurry is caused to flow between the tool and the workpiece. A small space filled with abrasive develops between the vibrating tool and the workpiece. Tiny particles of abrasive are accelerated by the motion of the tool tip and are driven with tremendous impact against the work, thereby chipping or grinding an exact counterpart of the tool face into the work. It is from this action that the term "impact grinding" is derived. The work is fed up to the tool to maintain constant force between the two

Despite the fact that the abrasive particles strike the work with impact forces of up to 150,00 times their own weight, the grinding force required seldom exceeds 10 lb. This fact, plus the absence of direct tool-to-work contact and the presence of the cool abrasive, means that impact grinding is a "cold cutting" process. The work material is not stressed or distorted in any way and its temperature is not raised.

The rate at which material can be removed by impact grinding depends directly upon the amplitude of the cutting tool vibration. High amplitudes provide



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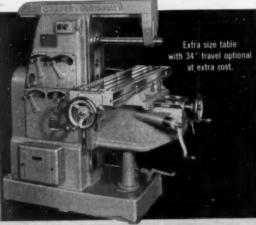


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high acceleration to the abrasive particles and ease the flow of new abrasive between the tool and the work. Cutting tool amplitudes vary from 0.004 inch with tools of small cutting face area to 0.0006 inch with tools having large cutting face areas. Amplitudes smaller than 0.0006 inch require excessive machining time.

Performance of a typical impact grinder, using a ½ inch diameter tool

and a 320-grit boron-carbide abrasive, is shown in the accompanying table. As shown in column 1, the abrasive grit wears away both the tool and the workpiece during grinding. Wear ratios are as high as 250 to 1. Tool wear is confined mostly to the bottom face of the tool, where dimensions are not usually critical. Because there is little lateral cutting action, the precise profile of the tool is maintained.

With each tool and material combination there is a maximum grinding area which it is impractical to exceed. These are shown in column 2 of the table. Impact grinding can be performed over surfaces of larger extent, but of approximately equal grinding area, if the desired shape is first roughed out by conventional machining methods, preferably before the workpiece is hardened.

Grinding rates for a variety of materials are indicated in column 3. These figures are for a ½ inch diameter tool using the 320-grit boron-carbide abrasive, and summarize experience obtained in hundreds of operations.

The surface finish achieved by impact grinding can easily be controlled by selection of abrasive grit size. The curve in Fig. 2 shows the finish that can be obtained on metallic surfaces for a wide

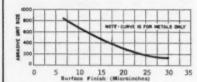


Fig. 2. Relationship of abrasive size to surface finish.

range of grit sizes of boron carbide. Such finishes require that a constant supply of abrasive be maintained between the tool and the work surface. If cored materials are used, abrasive flow can be supplied from beneath the work. For trepanning cuts, a hollowed tool can be used to allow flow of abrasive through the tool.

From a paper given at the ASME Semiannual meeting. The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

Competition Begins at Home

By Dr. Joseph W. Barker

President
The American Society of Mechanical
Engineers
New York, N. Y.

American is an entity, complete of itself, interacting, it is true, with other national entities, but nevertheless containing within itself all the ingredients necessary for its growth and success—or for its decline and failure. You have all heard the figures that tell how the Russians are outstripping us in the training of scientists and engineers. Without ignoring these figures, it should be our purpose to solve this problem in terms of our own requirements, and not in terms of a frantic contest to make our statistics look better.

The shortage of scientists and engineers in this country should be examined, therefore, in terms of the only index that amounts to anything; that is, the ratio between the number of engineers available and soon to be available



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on the one hand; and on the other hand, the number needed and soon to be required. Using that index, we have evidence that the engineering shortage is extremely serious and that it may get a lot worse before it gets better. The schools have been having trouble getting people qualified to teach our potential engineers; they can't compete with industry, and, of course, that shortage means a reduction in our ability to train more engineers. And so it goes, in a vicious circle that means trouble.

Demand for Engineers

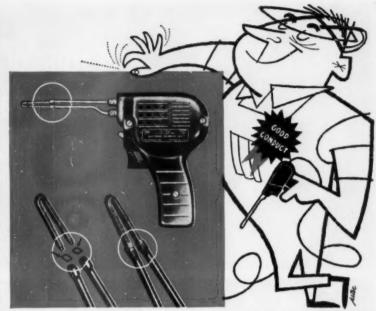
One of the reasons this problem is getting worse is that technological progress is creating a fantastic demand for engineers. McGraw-Hill Publishing Co. reports, for instance, that one aircraft firm has found it needs 1,400,000 engineering man-hours to develop a typical modern fighter plane. In 1940 it took only 17,000 hours; by 1960 it is expected that the figure will reach 2,000,000 hours.

We get a lot of advice as to what can be done about the engineer shortage and it comes from all kinds of people, most of them experts in their fields. A survey was taken at the ASME Semiannual Meeting at Cleveland, asking the question: "What measures do you think should be taken to end the shortage of engineering manpower?" Among the answers were the suggestions that engineers be paid more money, that a better job of selling engineering as a profession be done, and that we should take measures to make better use of the engineers we have by using technicians to carry out the routine details. All of these measures can be used to solve the particular engineering shortage problem of your own company.

But you may also serve yourself and vour country better if you will also direct some of your energies toward the solution of the over-all problem. I have two suggestions: first, take a personal interest in your own local school system and help to find unique solutions to its peculiar problems. Second, increase the amount of your personal and corporate gifts to your alma mater. You received more than you paid for in your professional schooling. Now help to pay back some of that difference.

Competition begins at home. Let's get competition in improving our local school systems and our collegiate science and engineering institutions. Competition for quality-not competition in numbers with Russia.

From a paper given at the ASME Fall Meeting of The American Society of Mechanical Engineers, 20 W. 39th St., New York, N. Y.



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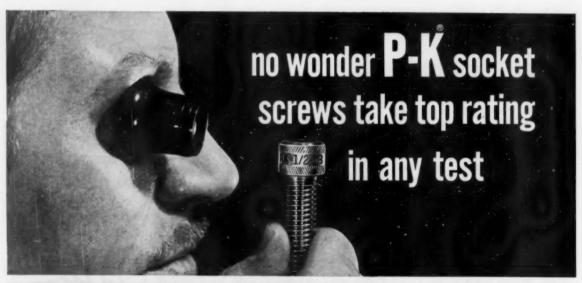
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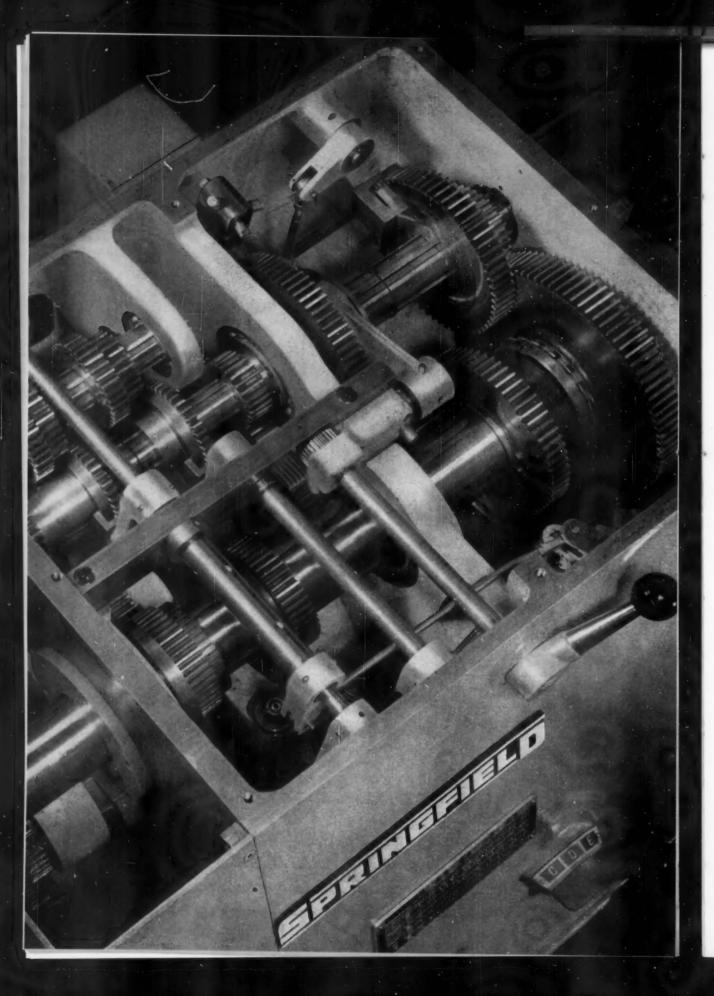
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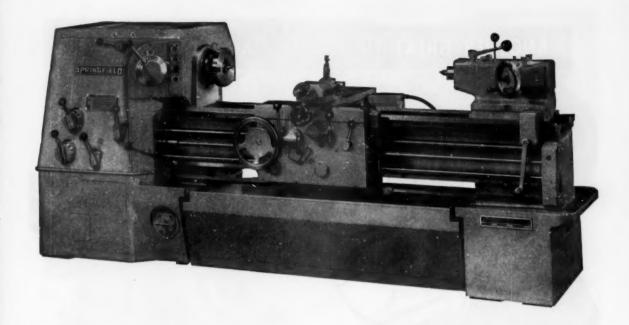
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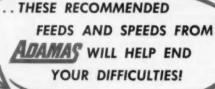
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TEST WITHOUT OBLIGATION! For an actual machine test or detailed titanium machining literature, contact: Technical Service Div., ADAMAS Carbide Corp., Dept. 222, Kenilworth, N. J.



ADAMAS RECOMMENDED FEEDS AND SPEEDS for machining TITANIUM ALLOYS* (For machining commercially pure titanium, type TI-75A, double speeds.)

	Scaly Forgings	No scale semi- roughing	Finish turning, boring & facing	Milling ADAMAS Grade A				
Grade of Carbide	ADAMAS Grade BB†	ADAMAS Grade B	ADAMAS Grade A					
SFPM	50	150 - 200	300	350				
Food	.010020	.010020	.005010	.003 per tooti				
Depth of Cut	.250500	.250	.015032					

HELPFUL "TIPS"

How To Eliminate Vibration

To end tool vibration, use as large a shank size as possible on the tool. For severe roughing or scaly cuts use a high lead angle. Another "tip" is to hone a 45° land on the cutting edge approximately .005" to .010" wide . . . or reduce feed.

What To Do About Scale or Oxide

In machining titanium forgings covered with scale or oxide, use as large a radius as possible on your tool. This radius, however, must be kept below the point where vibration will be encountered.

* These figures represent approximate starting points and should be adjusted to your own machines and set up conditions.

Figures on ADAMAS Grade BB represent a rough face front flange operation of 682 Titanium Alloy on a Bullard VTL machine. The size of the material was:

Diameter—171/1" Length of cut—5"
ADAMAS Grade BC delivered 12-15 pieces per grind. Figures on Grades A & B available upon request.

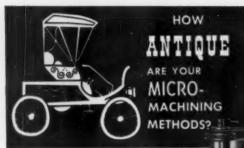


ADAMAS

CARBIDE CORPORATION

KENILWORTH, NEW JERSEY

Producers of tungsten carbide tools, tool tips, dies, wear parts, Dex-A-Tool and Ceralox.



SMALL DRILLS MUST BE HELD IN PRECISION COLLETS TO ASSURE ACCURACY TEVIN MICRO-DRILL PRESS

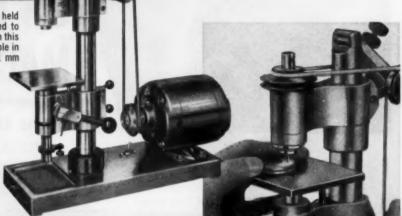
> FOR VERY SMALL HOLES **DOWN TO .002"**

In the LEVIN micro-drill press drills are held in precision collets. Runout is reduced to practically zero and drill breakage from this cause is eliminated. Collets are available in a complete range of sizes down to .1 mm (.004'').

SPECIFICATIONS:

Size of table is 3-3/4" x 4". Maximum table travel is 1-1/2". Greatest distance between table and end of spindle 4". Preloaded ball bearing spindle with four speeds 1725, 2600, 3000, 4700 RPM. Motor 1/2 HP, 110V, 60C. The micro-drill press may also be had with a 3450 RPM motor, doubling the above

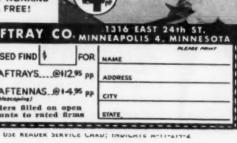
Send for catalog M describing com-plete line of micro-drilling equipment, collets, instrument lathes and precision tools.



OUIS LEVIN & SON, INC.-3610 S. BROADWAY-LOS ANGELES 7, CALIFORNIA

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-11-214-1





Masters of A Thousand Set-ups

eliminate expensive jigs

Hold any shape stock aligned with miller, shaper, drill press or tapper. Famous for key-way setups. Value proven in large and small shops. 4 sizes

Write for illustrated folder



WALTER W. FIELD & SON INC 39 HAYWARD STREET, CAMBRIDGE 42, MASS

USE READER SERVICE CARD: INDICATE A-11-214-3



USE READER SERVICE CARD: INDICATE A-11-214-



- . 12" SWING
- . 1" COLLET CAPACITY
- 1%" SPINDLE BORE
- 23" and 35" CENTERS
 - VARIABLE SPEED OR DOUBLE V-BELT DRIVE

ACCURACY, CAPACITY AND POWER COMBINED IN THIS 12" LATHE

This 12" swing lathe typifies Logan advanced design and rugged construction. Gears are extra wide and strong. Shafts are extra heavy. The lead screw has a full 1%" diameter. The precision carriage rides on a two-V-way, two-flat-way bed that is rugged, precision ground and warp-free. The heavy spindle turns on oversize ball bearings, no bearing adjustment needed for any speed between 38 and 1575 rpm. This lathe, and every Logan Lathe from 14" swing down to 9" swing, is dynamically balanced before it is shipped. The result is sustained accuracy and smooth, quiet power on every lathe turning operation. See your Logan Lathe dealer for more facts—or mail us the coupon below.



THIS COUPON

will bring you full details on Logan Lathe construction and specifications.

LOGAN ENGINEERING CO.

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City......Zone...State.....

Get this **Inside Story**

for Lower-Cost Air Gaging

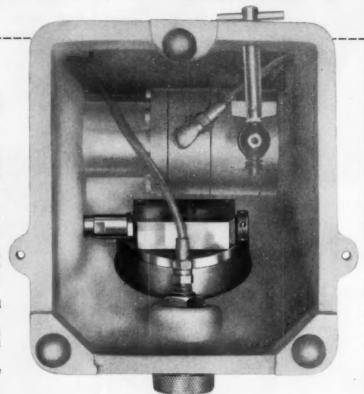


This simple venturi tube, and its corresponding dial, is the real key to more accurate, more trouble-free air gaging performance. The Taft-Peirce CompAIRator uses this tube in a unique *Venturi Circuit* which provides advantages not found in any other type of air gage. Check these exclusive extras...

- Easy and inexpensive magnification changes — switch this venturi and dial in just five minutes
- Only 10 pounds operating pressure, cuts air cost in half
- Fast reaction permits remoting base unit from fixture without using "booster" — no time lag or lowered sensitivity
- Velocity-type venturi circuit permits checking smallest diameters with standard gaging members ID's down to .055"
- Wide tolerance range: can gage tolerances as narrow as .0001", or can be designed to check as wide a range as .125"
- Full linearity through 180° of dial
- Built-in fast response, easily tied in with automatic machining and inspection operations
- Can be mounted at any angle without disturbing readings



Teft-Peirce Single Diol CompAlitetor, complete with plug and mosters. CompAlitetor, care also available in double or multi-dial units, can be used with standard air plugs, elt rings, and air snap gages — directly attacked to cabinet or to air hose. Special flatures designed and built to order.



The simple Venturi circuit, extreme flexibility, and trouble-free operation make Taft-Peirce Air Gaging your lowest-cost quality control tool — whatever the production rate. It has been proved in hundreds of installations, performing all kinds of gaging operations.

Get ALL the facts . . . from your nearest Taft-Peirce representative, or write direct for Air Gage Catalog No. 613.



TAKE IT TO TAFT-PEIRCE

TAFT-PEIRCE MANUFACTURING CO. WOONSOCKET, RHODE ISLAND





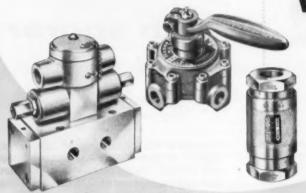


for Dependable Fluid Power

and Reliable Controls



Designed to assure most efficient control, there are many types and sizes of Hanna Valves available for hand, foot and electric operation, for automatic, remote and speed controls.



It may not take over half a century to design and build a superior line of cylinders and valves . . . but the experience a company compounds in that time surely helps. Hanna has that background.

What does it mean to You, today - in terms of cylinders and control valves? - Basically these important things:

- · Products designed and manufactured to the very highest standards of performance . . . not built down to a price-although they are competitive.
- · A line so complete that you can specify a

"standard" Hanna cylinder or valve to suit your "special" jobs.

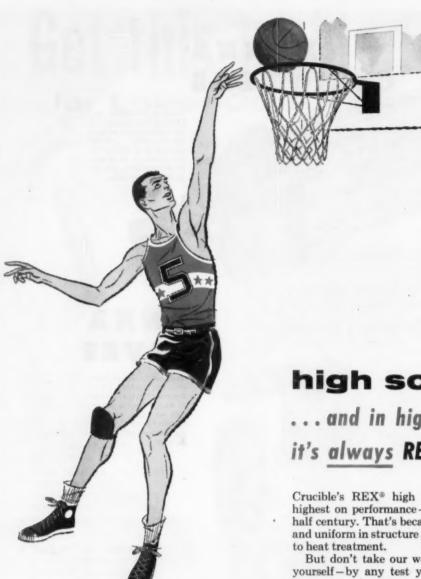
· A plant engineering staff that backs a nationwide regional engineering-sales organization to help you quickly solve difficult problems-and to follow through on all your "needed now" requirements. Many Hanna Representatives stock the standard sizes and types of Hanna Products-the Hanna Plant, of course, does, too.

Whether you need cylinders and controls for equipment that is for resale, or for your own plant use . . . call or write your Hanna Representative (see classified telephone directory or Thomas' Register) or write us direct.

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT... CYLINDERS...VALVES

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high scorer

... and in high speed steels, it's always REX

Crucible's REX® high speed steel always scores highest on performance-as it has for more than a half century. That's because it is consistently sound and uniform in structure . . . with dependable response

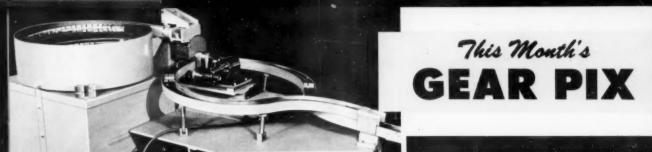
But don't take our word for it. Check REX for yourself-by any test you choose. You'll discover that recent improvements in manufacturing techniques have made it better than ever-why REX is today, as it's always been, the standard by which all other high speed steels are compared!

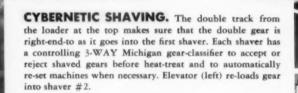
REX is immediately available at all Crucible warehouses, or on prompt mill delivery. For a list of helpful data on REX and other special steels, write for a free copy of the "Crucible Publication Catalog." Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.

CRUCIBLE first name in special purpose steels

Company

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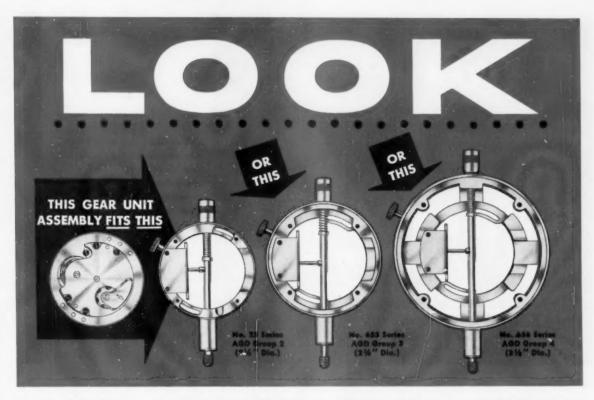
FULLY AUTOMATIC

SOUND TESTING follows heattreat. These Michigan speeders (right) with tunable electronic audio-pickup eliminate variable human element in sound testing. Can be set to reject gears for excess noise in any desired preselected frequency band.

TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.





SIMPLE INTERCHANGEABLE DESIGN

Makes Starrett HIGH PRECISION Dial Indicators So Fasy to Maintain

If you use dial indicators — particularly if you maintain your own repair service — think what this exclusive Starrett feature means to you. Simple Interchangeable Construction means fewer parts to stock, less maintenance time and lower upkeep cost plus longer, more accurate life for all your dial indicators.

The entire gear assembly is identical and interchangeable in all comparable models of Starrett No. 25, No. 655 and No. 656 regular and Nonshock indicators. With only two different gear unit assemblies, and by merely changing the combination of gears, 105 different models can be made up with regular mechanism. By changing the case assembly to spindle and rack sleeve, most models can be converted to Nonshock.

Simple Interchangeable Construction also means fewer parts and these are heavier and more rigid. Rugged, rigid, simplified design means Starrett Dial Indicators are subject to far less friction and have a longer, more accurate life.

SEND THE COUPON for catalog describing the complete line of Starrett High Precision-Low Friction Dial Indicators.

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SINCE 1880 WORLD'S GREATEST TOOLMAKERS

Truly Sensational!

IN SIMPLICITY . . . VERSATILITY . . .
PRECISION-ACCURACY . . . ESPECIALLY
IN SAVINGS IN COST
PER FINISHED PIECE

SIDNEY

FLUID TRACER

The finest precision duplicating attachment ever offered to industry since cutting tools were invented

INSTANTLY... precisely and in any desired quantity (no matter how small or extended a run) every change in contour is transferred from master piece or template to the cutting tool. It also controls the hydraulically actuated cross feed and the longitudinal movement of the carriage.

Changeover to standard lathe operation or back to tracer work requires only a few seconds without the addition or removal of any parts.

Model 32 Dial-Master Sidney Engine or Tool Room Lathe with Sidney Fluid Tracer



30 OR MORE HYDRAULICALLY CONTROLLED PRE-SELECTIVE SPINDLE SPEEDS

A revolutionary innovation and presented as a "SIDNEY FIRST" as long ago as the Machine Tool Show of 1947 used regularly as a standard SIDNEY feature over since But only recently adapted by other lathe manufacturers a fitting tribute to SIDNEY pioneering and leadership.

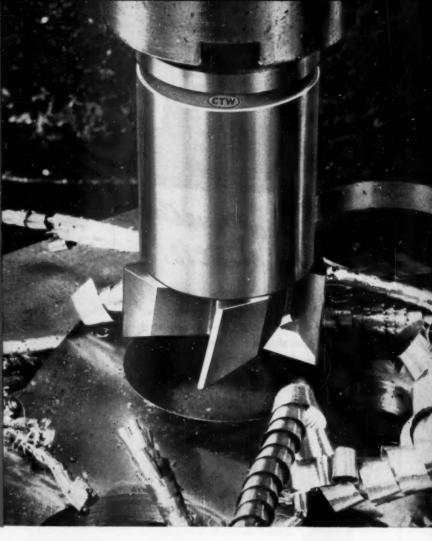
THE SIDNEY FLUID TRACER is remarkable! It saves time and costs and increases production.

Write for bulletin or ask for representative to call at your convenience.

THE SIDNEY MACHINE TOOL CO. . SIDNEY, OHIO

Builders of Precision Machinery since 1904





After the heaviest cutsthey disengage with a twist of the wrist

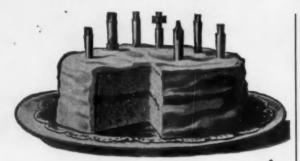
Continental Counterbores are designed so that cutting torque produces compression rather than shearing stresses. This counterbore never binds—you get quick, easy disengagement after all cutting operations. Antiwedging action saves time and tools.

Continental Counterbores have double driving lugs on the cutters which engage double abutments in the holders, making a single powerful tool out of the cutter and holder. Double bearings, one above and one below the lugs and close to the cutting edge, guarantee rigid alignment of holder and cutter. For more information or literature on Continental Counterbores, call your local Ex-Cell-O Representative or write to Continental Tool Works in Detroit.

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DIVISION OF

EX-CELL-O CORPORATION . DETROIT 32, MICHIGAN



You CAN Have Your Cake - and Eat It!

You can profit by the economy of straight shank small tools (as compared with taper shanks) yet keep the convenience and speed of taper shanks by driving them with



Glowser UTILITY DRIVERS

Each Glenzer Driver outlasts many small tools and provides a removable taper for each one.

Customers Report 40% to 75% Savings

Glenzer Utility Drivers (Sleeves) are made in all standard tapers and for all small tool sizes—either decimal, fractional, numbered or lettered.

Drive your drills, reamers, taps, end mills, key slot cutters and similar small tools the Glenzer Way for maximum efficiency and economy.

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Send for Index Circular A

THE J. C. GLENZER CO., Inc.

USE READER SERVICE CARD; INDICATE A-11-224-1

the all new. VERTICAL or HORIZONTAL

101 tapper

A brand new . . . Kaufman Tapper with more new operating, control, and production features . . than has ever before been incorporated into a single tapping head. You can mount it vertically or herizentelly arrange it in combinations to do two or more operations . . . or mount if herizontal ar engular in combination with vertical heads to do verieus operations simultaneously. Additional revolutionary features include:



- An extremely sensitive terque control . . . which signals overload, stops the machine automatically to avoid top breekage.
- A pressure lubricated lead
 screw.
- Positive precision depth control.
 Air operated clutch with instant reversal.
- reversal.

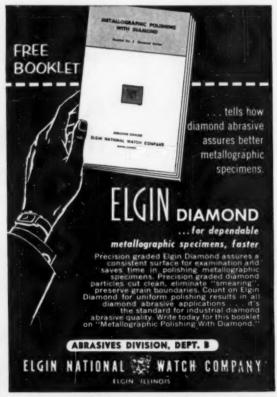
 A simple non-reversing motor
- Spindle speeds ranging from 35 to 785 RPM.
- These and many additional features are incorporated into

These and many additional features are incorporated into the new 101 Series Kaufman Tapper. For more complete, information about this and other Kaufman Tappers, write

KAUFMAN MFG. CO.

553 S. 29th Street Manitowoc, Wisconsin

USE READER SERVICE CARD; INDICATE A-11-224-2



USE READER SERVICE CARD; INDICATE A-11-224-3

Ingersoll Cutter Grinder

SAVES UP TO 5 1/2 HOURS OF EVERY WORKING DAY



Customers using the new Ingersoll Cutter Grinder report time savings of 24% over older Ingersoll machines and up to 70% over standard tool grinders...2 to 5½ hours of an 8-hour working day.

How do your grinding times compare with these?



12 minutes

6" Type NX 10 HSS blades



40 minutes

10" Shear Clear 20 T.C. — tipped blades



50 minutes

10" Shear Clear 38 T.C. — tipped blades

To demonstrate time savings available in your grinding room, we would like to actually sharpen some of your cutters on a new Ingersoll Cutter Grinder. Just write and ask us to have an Ingersoll cutter engineer make the arrangements.

WRITE TODAY FOR CUTTER GRINDER MANUAL 64F

THE

INGERSOLL

MILLING MACHINE COMPANY

ROCKFORD, ILLINOIS, U.S.A.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES $\frac{SHEAR}{FIERF}$ ORIGINATORS OF $\frac{FIERF}{FIERF}$ CUTTERS



Manhattan Centerless Wheels Handle Roughing and Finishing Jobs—at Top Grinding Speeds

To do both jobs efficiently-roughing and finishing -Manhattan Centerless Wheels are specially bonded. They have a high grit-carrying rubber bond that insures maximum metal removal with every pass—a rubber bond that produces desired finishes to required tolerances even with coarser-grained abrasives. By controlling feed rate and the amount of stock removed you can move from roughing to finishing operations with ease and efficiency . . . without time consuming wheel changes! And be-

cause of the greater strength built into Manhattan Rubber Bond Centerless Wheels you can achieve superior finishes

to close tolerances at grinding speeds up to 8500 sfpm! You get a faster, better job-at substantial savings in production time and costs.

Manhattan Rubber Bond Centerless Grinding and Regulating Wheels are custom-made for your specific requirements. Manhattan Regulating Wheels are supplied either plain or core-mounted. Manhattan Core Mountings also provide savings in wheel costs. Ask a Manhattan representative to show you how Manhattan Centerless Wheels and other high speed, heavy duty abrasive wheels give you "More Use per Dollar".



MANHATTAN RUBBER DIVISION - PASSAIC, NEW

AYBESTOS-MANHATTAN,





















r R/M products include: Industrial Rubber . Fan Belts . Radiator Hose . Brake Linings . Brake Blocks . Clutch Facin Asbestos Textiles * Peckings * Engineered Plastic, and Sintered Metal Products * Laundry Pads and Covers * Bowling Balls New!/utionary/

A "natural" for aircraft parts

Colonial
ONE-WAY
Surface
Broacher

"Eliminates" Return-Stroke
"Eliminates" End of Stroke
"Doubles" Length of Stroke

For complete information on the new Colonial ONE-WAY surface broacher, ask for Bulletin VC-55.

MECHANICAL DRIVE AC MOTOR VARIABLE SPEED

HYDRAULIC OR MECHANICAL FIXTURES

CARBIDE OR
HSS BROACHES
NO PIT REQUIRED
FOR LOW CEILING

LONGER TOOL LIFE

EXTREME ACCURACY GUARANTEED

COLONIAL

STROKE LENGTH UP TO 200 INCHES

SPEEDS UP TO 50 FEET/MIN.
ONE LONG STROKE—
ONE PART

OR MULTIPLE SHORT STROKES ON MULTIPLE PARTS

CONTINUOUS OPERATION

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UNIFIED BROACHING is the key to successful broaching

REARS GEARS A consi Speede which, of attitude This AUTOMATICALL

A consistent electronic ear in the Red Ring Gear Speeder has replaced the human sense of hearing which, as we know, varies with the fatigue and mental attitude of the listener.

This electronic sound discriminator is readily ad-

justed to reject gears at any point within the range of audible noise frequency and intensity.

The Model GSR Speeder for gears and pinions in the smaller sizes is fully automatic. Gears are loaded, run in both directions, with and without a brake load and are either passed or rejected by the electronic sound discriminator as a continuous operation. Write for Details.

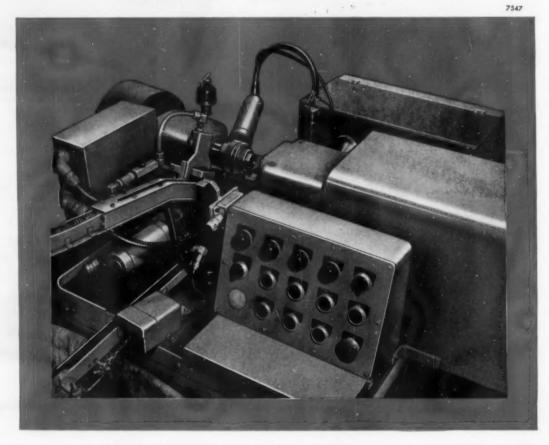
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AND FELIPTOID TOOTH FORM



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WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT



Chances are at least 98 out of 100

that this part
will be **perfect**

The Metal Stampings Plant, Sylvania Electric Products, Inc., keeps rejects under 2%—even on complex, close-tolerance parts produced at rates to 9,000 per hour. Optical gaging helps set this level.



The diode plate shown above is an example of the complex, mass-produced, parts turned out to close tolerances by The Metal Stampings Plant, Sylvania Electric Products, Inc., at York, Pennsylvania. Tolerances run to \pm .001"; as many as 10 dimensions must be held, including inner and outer diameters. Yet even on parts more difficult than this—parts with tolerances of .0005" and forming rates of 9,000 per hour—Sylvania gets an acceptance rate of over 98%.

Inspection on Kodak Contour Projectors helps Sylvania do the job to the satisfaction of its customers, both internal and external. Operators check the first parts produced by every machine to assure correct setup. Then, throughout the run, production samples are checked at regular intervals—making certain each machine is holding to tolerance. The speed with which these parts can be checked using optical gaging methods has helped slash rejection rates more than 50% since Kodak Contour Projectors were installed.

If you have difficult inspection problems involving quantity, speed, close tolerances or hard-to-measure dimensions like shoulders, holes, radii or angles, there's every reason to expect a solution by optical gaging on a Kodak Contour Projector. There's a representative in your area who can tell you more. To get in touch with him, or for a copy of the booklet, "Projection Gaging with Kodak Contour Projectors," write Special Products Sales Division.



Little training is required to operate a Kodak Contour Projector. Operators sit comfortably in a fully lighted room. The work gets out in a

EASTMAN KODAK COMPANY, Rochester 4, N.Y.

the KODAK CONTOUR PROJECTOR



Multi-Flex

quiz for design

engineers who want greater freedom of design

WHAT ARE U. S.
MULTI-FLEX
PRODUCTS?

They are accordion-like, tubular rubber products that have a versatility and an adaptability impossible to duplicate in connections made by conventional methods. Produced by United States Rubber Company, they are made of natural or synthetic rubbers—with or without cotton, asbestos, glass or nylon fabrics. With few exceptions, all U. S. Multi-Flex products are made to order for specific applications.

MULTI-FLEX

PRODUCTS ARE CIRCUMFERENTIALLY CORRUGATED! This gives flexibility, rigidity, and the ability to take movements in axial extension and compression. Other qualities are:

• Resistance to crushing and fatigue • Resistance to extremes of temperatures, abrasives, corrosives, oil, water, and grease • High travel ratio.

WHAT ARE SOME EXAMPLES OF MULTI-FLEX

PRODUCTS?



Above are shown only six of the various styles of U.S. Multi-Flex boots. Because Multi-Flex boots are custom-made, THEY CAN BE "TAILORED" TO MEET THE EXTENSION, COMPRESSION AND DESIGN REQUIREMENTS OF ALMOST ANY APPLICATION.

APPLICATION FOR

MULTI-FLEX!

In industry: Multi-Flex boots are used for rams in hydraulic presses making grinding wheels or other abrasive materials; on adjusting screws in grinders and machine tools; for guide rods in mechanical stamping presses; for reciprocating parts and for pistons and worm gears in a multitude of applications; for any hydraulic cylinders and other reciprocating parts requiring protection.

Any maker of equipment with moving parts which need protection should investigate U. S. Multi-Flex®. For engineering advice, get in touch with any of our 27 District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.



Mechanical Goods Division

United States Rubber

The Rolling Action is built right in

HELLER Spiral-Cut half round files

Filing out a concave surface or rounding out a hole is no longer a job restricted to master craftsmen. HEL-LER SPIRAL-CUT HALF ROUND files eliminate the need for skillful twisting action once so necessary to produce smooth, even work. This rolling action is now designed right into a HELLER SPIRAL-CUT HALF ROUND file.

A straight stroke with an ordinary half round file leaves bumps and ridges unless the user twists it just right. The same straight stroke with a HELLER SPIRAL-CUT HALF ROUND makes a smooth and true-arc surface.

Everyone gets perfect results with this new SPIRAL-CUT, an exclusive feature of HELLER HALF ROUND files. This new cutting principle is another of many "firsts" brought out by HELLER in their continuous search for a better file.

these brands always

VIXEN

NUCUT®

HELLER American-Swiss

SWISS PATTERN

assure HELLER quality

LOOK FOR THE

STRAIGHT CUT

Above is a cross section showing

the smooth, true

arc left by the

HELLER SPIRAL-

CUT HALF

ROUND file. Compare it with

the scalloped

trated below)

left by an ordinary half round

file using the

same stroke.

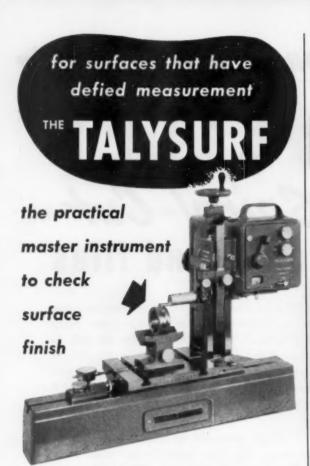
HELLER TOOL CO.

A subsidiary of Simends Saw and Steel Company

NEW COMERSTOWN, OHIO

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OUR HELLER DISTRIBUTOR CAN SUPPLY ALL YOUR FILE NEEDS





Diamond stylus of .0001" standard tip faithfully registers all scratches. It is power traversed under a pressure of only .1 gram (.0035 oz.) — important for all surfaces; a "must" for soft materials.

Produces true inkless straight-line graph tracing actual profile of surface irregularities through electrically interlocked and precisely repeating mechanism.

After a single stylus traverse, the integrating meter indicates an average to American Standard ASA B46.1-1955. There is no wavering of the pointer—it remains electrically locked at the correct average reading.



The Talysurf is your key to manufacturing and inspection methods for reject-free automatic production of parts requiring highest surface accuracy.

Complete information will be furnished without obligation—write Dept. T-106

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USE READER SERVICE CARD; INDICATE A-11-232-1

GEORGE 1. DETTERBECK CO.

World's Largest Exclusive Manufacturer of SCREW MACHINE TOOLS!

CUITING CAMS

HIGH SPEED STEEL AND
CARBIDE FORM TOOLS
SPECIAL CUITING STOOLS
TOOL BITS
BOX TOOLS
BURNISHING TOOLS
REVOLVING STOPS
RECESS SWING TOOLS
FORMING SWING TOOLS
Standard sizes
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in stock.

We specialize in one thing only...
designing and making
SCREW MACHINE TOOLS!

45 years experience goes into every tool we make. They come to you ready for use ... Precision design... Skilled workmanship... Finest materials.

Our extensive facilities save you TIME ... MONEY... and give you accuracy, quality and quick service.

• 45 Years at the Same Address

GEORGE L. DETTERBECK CO. 1871 Clybourn Avenue · Chicago, Illinois

USE READER SERVICE CARD; INDICATE A-11-232-2



Originators and Manufacturers of Helical Reamers and End Mills

> Helical Taper Pin Reamers Shipped by Return Mail

GAMMONS - HOAGLUND

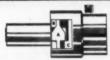
Company

400 Main Street, Manchester, Conn.

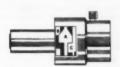
USE READER SERVICE CARD; INDICATE A-11-232-3

Cut CITT

TAP AND DIE HOLDER



Ready to start threading operation, clutch slightly engaged at C.



Instantly engaged to full contact between A and C as soon as tap or die engages work.



Fully released showing ample clearence between contact points of clutch. New Release Mechanism
allows for easy adjustment
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Instant engagement
at full contact . . . Fast
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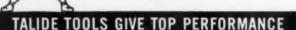
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Illustrated at the left, the NEW American Pull-Down Machine is tooled for full automation of parts from the floor to the dial-index unit pictured, and on through broaching position to final parts ejection back to the production line. Such automatic components can be added initially or later as individual production requirements demand, and without the usual high cost of special engineering.

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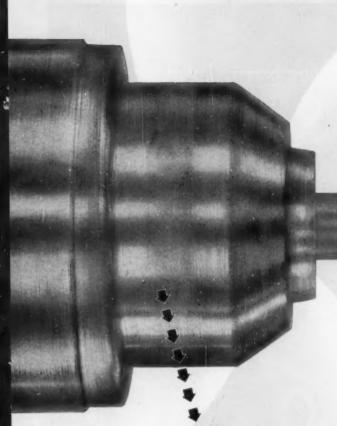
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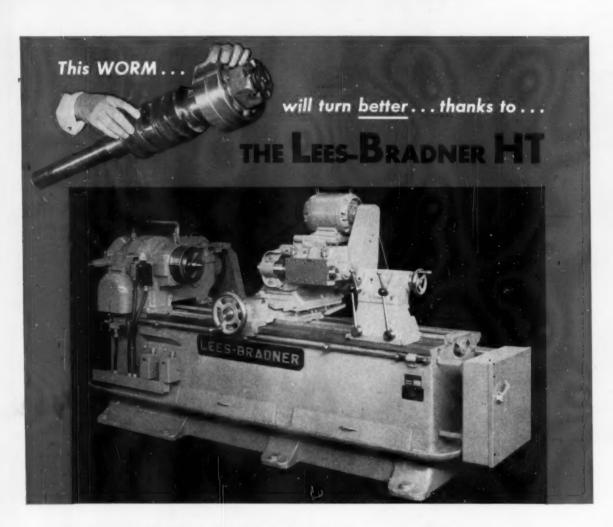
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Many tough thread milling problems like this have been, and are being, solved by this remarkably versatile machine.

Contact us or your local Lees-Bradner representative for complete information on fast, precision threading with the Model HT Universal Thread Milling Machine.

Details on Worm Gear Production

Hob Spindle Speed	61 R. P. M.							
Circular Pitch	1.420"							
Pitch Diameter	3.728"							
Outside Diameter	4.625"							
Threading Time	1 hour 23 mir							
Material	2315 Steel							
Weight of Worm	51.76 lbs.							



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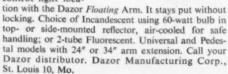
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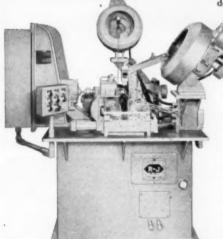
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ONE HOPPER. At the right we show a typical semi-automatic machine which lends itself to certain kinds of work—short run, for example—better than a full-automatic. The operator manually sets the part piece, then the needles are delivered and the assembly completed automatically. Machines of this nature have a capacity governed largely by the dexterity of the operator.





A TYPICAL NEEDLE BEARING



The bearing shown here is typical of the many for which we have built assembly machines. The needles are set into the cup, after which the retainer ring is pressed in place. At the proper time, a measured shot of lubricating grease is delivered into the assembly. This particular bearing is used on universal joints.

THREE HOPPER, A machine of this type, as shown at the right, can be used to press in a retainer after the needles are placed in the cup. For example, the bearing illustrated above is assembled on this particular machine at the rate of 900 per hour.

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BOTH L.H. AND R.H. BENDS PRODUCED WITH SAME TOOLING

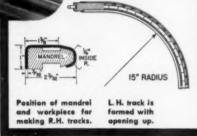
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 Closeup of tooling used for making 90° bend for right-hand track. Flexible mandrel, inserted in channel, insures smooth, wrinkle-free bends. Bending arm speed is 6.0 r.p.m.

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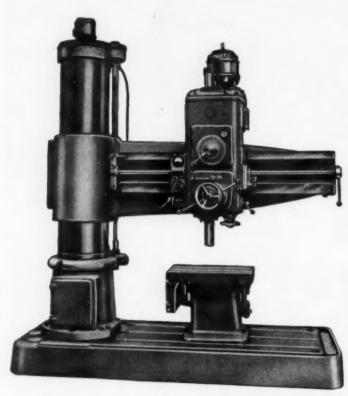
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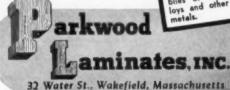
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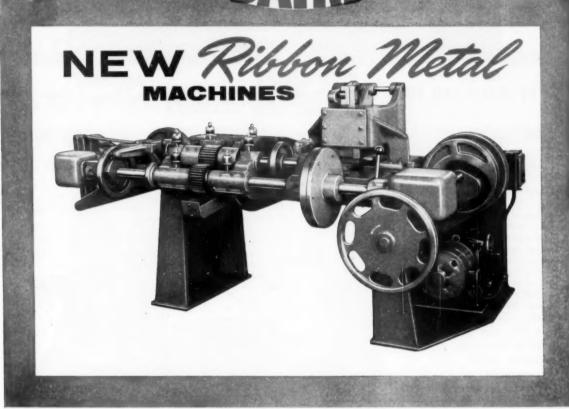
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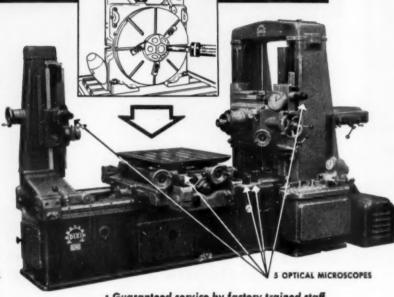
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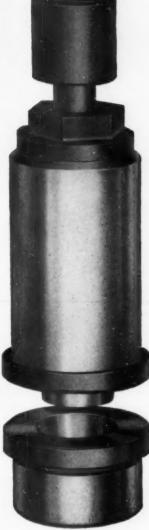
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Universal's Straight and Taper Plungers made in standard sizes save the time and expense of designing and machining special index plungers for multi-station tools. They come to you complete, ready for installation at approximately ¼ the cost of specially made plungers.

Universal Plungers greatly simplify jig or fixture manufacture because plunger body and bushing have same diameter so that all holes can be bored with same tool, often in same setting.



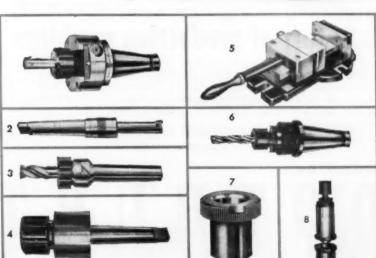




Soft pin knob permits connection to actuating lever or air cylinders by several different methods. Locating bushing, plunger and plunger bushing are hardened and ground.

Plunger is easily assembled from either top or bottom. And it can be removed in either direction by removal of hex nut.





UNIVERSAL ENGINEERING COMPANY

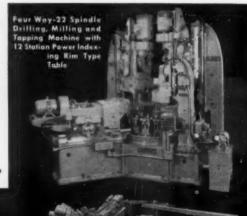
FRANKENMUTH 3 MICHIGAN

- (1) BORING CHUCK
- (2) MIKRO-LOK BORING BAR (3) STANDARD COLLET CHUCK
- (3) STANDARD COLLET CHUCK (4) FLOATING COLLET CHUCK
- (5) WEDGE-LOCK PRODUCTION VISE
- (6) "KWIK-SWITCH" TOOL HOLDER
- (7) STANDARD DRILL BUSHING
 (8) UNIVERSAL INDEX PLUNGER

140



Duplex Surface Broaching Machine 5, 10, 15 and 25 ton capacity



19 Station-115 Spindle **Drilling and Milling Machine**



Extremely Accurate Hammond Tool Room Grinder



Continuous Type Broaching Machine Built in Five Sizes



Single Slide Broaching Machine 5, 10, 15 and 25 Ten capacity

1, 2, 3, 4 and 6 Spindle Sensitive Drilling Machines



Two-Way Hydraulic Feed Vee Type Stub Baring Machine



Unique Bracket Type Hammond Radial Drilling

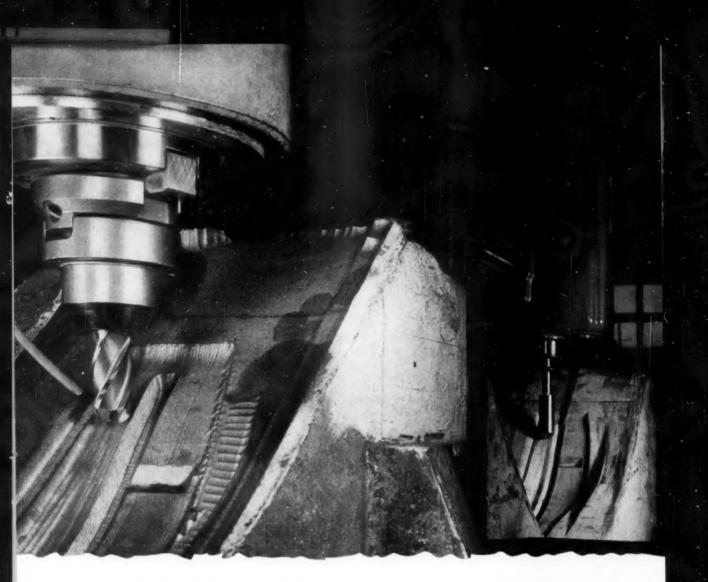
FOOTBURT line of production made and Tapping Machine

· Way Type Drilling, Boring, Reaming, Tapping and Milling Machines with One, Two or More Ways . . . Station Type Machines . . . Center Column Type Machines . . . Cylinder Boring Machines . . . Inverted Drilling Machines . . . Surface Broaching Machines . . . Sentitive Drilling Machines . . . Hammond

Radial Drilling Machines . . . Hammond Surface Grinding Machines . . . Manufacturing Type High Duty Drilling Machines . . . Independent Feed Drilling Machines . . . Special Machines.

THE FOOTE-BURT COMPANY, Cleveland 8, Ohio Detroit Office: General Motors Building

Engineered for production



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New CLEVELAND 4-flute center cutting End Mills reduce individual end tooth shock and assure smoother cutting action, particularly in plunge milling.

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BALL NOSE

SQUARE EN

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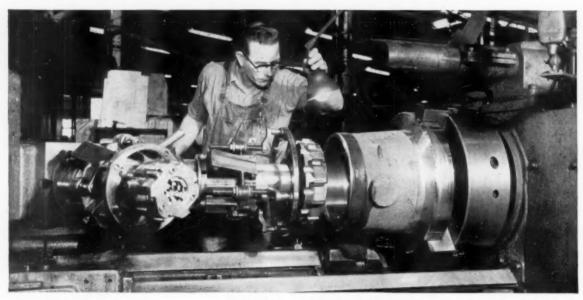
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WARNER & SWASEY 4-A TURRET LATHE

holds API accuracy on 13%" dia. thread at Cameron Iron Works—cuts machining time 35%



Warner & Swasey 4-A Universal Heavy Duty Turret Lathe cuts 13 1/8" API threads after machining 22" dia. flange and inside taper on these large alloy steel forgings,



In the oil fields of Texas, a pressure of 5000 psi is considered merely a working pressure. Confining such a tremendous force is routine for the oil well casing head housings produced at Cameron Iron Works, Houston, Texas.

And routine, too, is the machining of these housings and threading of the 133/8" dia. 8 pitch API threads on a Warner & Swasey 4-A Heavy Duty Turret Lathe. That's because the 4-A has the power, rigidity, and built-in accuracy needed to meet stringent API (American Petroleum Institute) requirements, plus the ability to efficiently produce parts in lots as small as 10 to 20 pieces—and at a time savings of 35%.

Cameron's own forge shop, utilizing the most up-to-date techniques, assures control of material quality in these large housings. Eighty pounds of tough metal must be removed in the machining operations which finish up to 22" diameter x 14½" long.

The combined special and standard hexagon turret tooling provides ample tool rigidity for tough hogging cuts as well as adjustment ease for close tolerance finishing cuts. The taper bore for the API thread is single point machined with the cutter held in a special contour slide tool which follows a taper plate held in an overhead bar. This method assures maximum concentricity, size control and finish—critical elements in efficient API threading. Flexible turret tooling such as this not only permits efficient small lot produc-

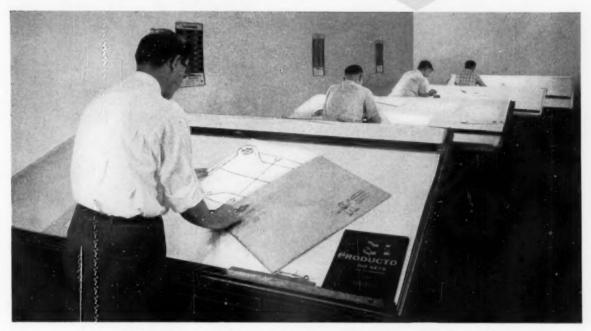
tion, but also allows the 4-A to handle frequent "break-ins" for rush jobs.

BIG JOBS LIKE THIS dramatically demonstrate the rigidity and accuracy that are built into every Warner & Swasey. The reinforced, one-piece head and bed construction, with induction-hardened (and completely protected) Vee-ways, plus the rugged design of the turrets on Warner & Swasey Saddle Type Turret Lathes, assures retained accuracy through years and years of tough metal cutting. When your job calls for extreme accuracy, with heavy metal removal, call in our Field Representative to discuss how you can do that job most efficiently.



YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

Why the Die Designer Prefers Ркористо Die Sets



He can specify Producto with complete confidence

The die designer likes to specify Producto die sets on his blueprints because they are a nationallyaccepted "brand." They're easy to get anywhere... and delivery is prompt.

He favors Producto because he knows he never has to compromise his die design. Even if the die layout is a little unusual, he will be able to select a die set to accommodate it from Producto's wide range of thicknesses and styles.

He also knows Producto has the equipment that can cut his tooling costs by letting him adapt his sets to a more economical basic design. Only Producto offers him complete foundry, patternmaking, welding and machining services for his special requirements.

The die designer recognizes Producto's Qwik-Fit Guide Pins as an important new feature that die makers want. He specifies them because they save up to 75% of the time normally required for die set assembly and disassembly.

The die designer likes to use Producto's new catalog, the industry's most practical tool. His die

layout is simplified when he uses Producto die set templates. And Producto provides him with costsaving ideas in the DIE SET DIGEST.

Most important, he can depend on *consistent* Producto die set accuracy to transfer from the drawing board to the press the precision and ingenuity of his die design.

Yes, the designer has found that Producto die sets justify his confidence in specifying Producto. You will, too.

TWO FREE AIDS to more economical, efficient use of die sets are available from Producto. All-new CATA-LOG NO. 11 makes ordering and selection job easy. DIE SET DI-GEST gives valuable tips for designers, builders and users of dies. Write for them today.



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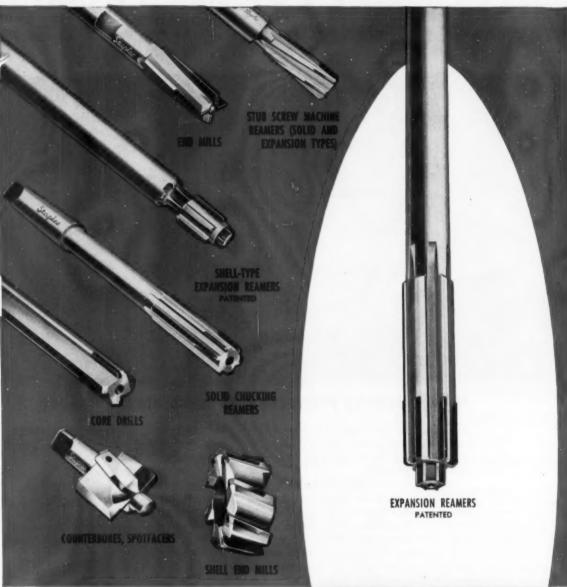


Wherever die sets are used

PRODUCTO

November 1956

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Lower Your Costs With Staples Carbide Tools

Precision and quality built into these tools results in overall economies as proven by production records.

THE Staple

TOOL COMPANY

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TORIGIN... A New Approach to

COLLET CHUCKING







-



STYLE 3

TORK-LOK DESIGN . . . Inclined flats in both collet sleeve and arbor shaft.

GREATER ACCURACY... Because flat surfaces are in constant contact on both expansion and contraction.

TORQUE TRANSMISSION . . . Greatly increased by self energizing feature of precision mated flats.

LESS COLLET BREAKAGE . . . Built-in safety stops control both expansion and contraction.

GEOMETRICALLY SEALED . . . Metal-to-metal contact excludes foreign matter thus reducing wear.

SELF-RELEASING . . . Preload feature assures easy part removal.

CONCENTRICITY . . . Locates straight or tapered holes on true center.

WOODWORTH

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PRECISION INVESTMENT CASTINGS . PRECISION HEAT TREATING OF AIRCRAFT PARTS

Guarantee TOP Performance and Maximum Life!

Specify THESE TOP QUALITY FEATURES ...

(Standard on Miller Cylinders at no extra cost)









You may wish to route this entire page to the proper department in your company, by using this handy form.

Additional copies on request.

To (Dept.)

"On all our future cylinder requirements, please specify the above quality features."

Signed_

Benefits To You

CASE-HARDENED Piston Rods (52-54 Rockwell "C") provide practically complete protection against damage from hammer blows, wrench-dropping, mishandling, and similar occurrences. Available from Miller at no extra cost.

The HARD CHROME PLATING over the case-hardened rods protects against scratch-damage and rust. Available from Miller at no extra cost.

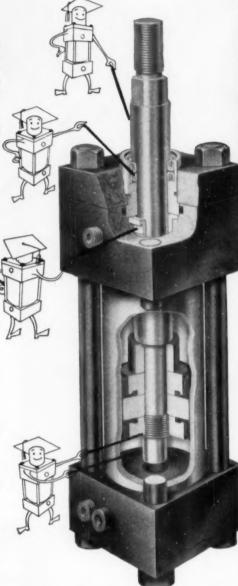
Benefits To You

"TEFLON" Rod Wipers and "TEFLON" Hydraulic Piston Rod Seals withstand temperatures from—100°F. to plus 500°F. They are impervious to practically all known chemicals, including the fire-resistant, special, and standard hydraulic fluids in current use. Available from Miller at no extra cost.

Benefits To You

Highest quality Black Ferric Oxide Finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation.

Cylinder heads, caps, mountings, pistons, followers, tie rods, and the unplated portions of the piston rods have this finish at no extra cost on all Miller cylinders. (This finish not recommended for water service)



NOTE: On all Miller Hydraulic Piston Seals: Leather Cup Seals are standard, Piston Ring Seals are optional at no extra cost, and "Teflon" Cup Seals are available at extra cost.

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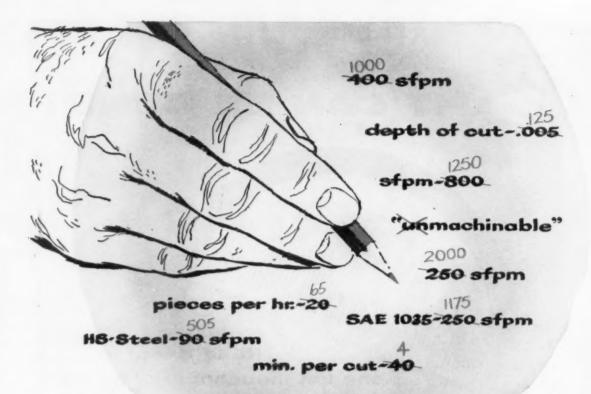
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Company



you can scrap your ideas of cutting-tool performance.

introduces a NEW ERA!

The figures above show the amazing improvements in production obtained through the use of STUPALOX sintered oxide cutting tools in place of tools previously used. Actually the figures are conservative, because tool performance in many cases was limited by inadequate power and rigidity of the machine tool.

Stupalox Tools are available now in commercial quantities, and a variety of styles and sizes of inserts. Write for complete data.

This compact plastic box provides a practical container for ten Stupatox sintered oxide inserts.

STUPAKOFF DIVISION OF

The CARBORUNDUM Company

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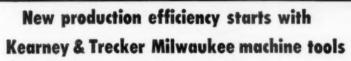


One of the nation's famous-name farm machin-ery manufacturers required a big, high-speed, precision production milling machine which would mill several surfaces on huge, 625-lb-transmission case castings in a single setup.



Kearney & Trecker's proposal was accepted and the result was this 44-ton, Five-Spindle Triplex machine which mills top, front and rear surfaces of tractor transmission cases at a rate of 23 pieces per hour.

Two horizontal spindles are mounted in duplex fashion and three vertical spindles on the massive bridge type head. Horizontal spindles, driven by 40-hp motors, carry 22" dia. cutters with 44 blades. Powered by a 50-hp motor, two of the vertical spindles have 22" dia cutters and the third spindle a 6 dia. cutter with 12 tungstencarbide blades.



Kearney & Trecker automatic production machines perform many operations to exacting accuracies and at lower cost. But most impor-tant to you — it's accomplished by combining standard design compo-nents with a minimum of special engineering. This means you get the production you want, the economies you need, from job-proven designs with minimum of capital investment.

With more than 50 years' experifacture, Kearney & Trecker has the all-around ability to meet your production needs. Take advantage of these abilities. They can pay off in lower machining costs and more in lower machining costs and more profits for you. See your Kearney & Trecker Special Machinery Division representative. He'll be glad to help you with your production requirements. Call him today.

For more details on machine illustrated ask for Data Sheet No. 1062. Booklet 'Doorway to a proven method for solution of big and metalwarking small metalwarking. small metalworking problems" is also yours for the asking.





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NEW AUTOMATIC

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Safety Two-hand safety trip (approved) and quick change foot pedal included. Single stroke or repeat selection.

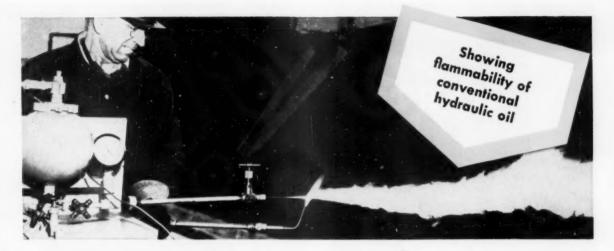
No alteration of machine needed—installed in one hour. Low cost—complete.

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Designers of low-cost, automatic production and safety devices.

GENERAL AUTOMATION CORP. 65 SOUTH BROADWAY, YONKERS, N.Y.

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No major modification necessary... simply clean present fluid thoroughly out of system and replace directly with Shell Irus Fluid 902. You can use it with complete confidence. Write for test data and all information.

SHELL OIL COMPANY

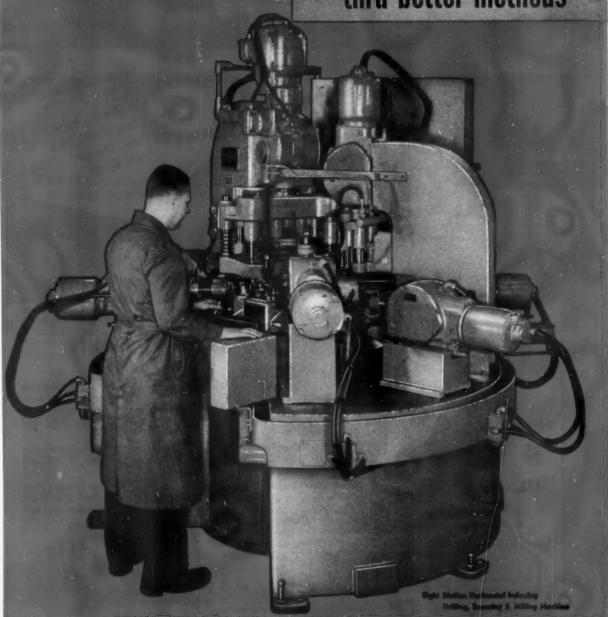
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Universal Drilling Machine for jet aircraft components



Vertical Single Unit Multiple Spindle Indexing Machine



Quill Type Air Hydraulic Drill Units



Quill Type Cam Units



Quill Type Lead Screw Tapping Units



Way Type Hydraulic Feed Units



Automatic Index Tables Horizontal and Vertical



Machine Bases

Designing and building automatic production machines like those illustrated are a "Hartford" specialty. Years of experience have proven that dependable high production and economy can best be brought to the user by means of standard machine components.

Now Hartford Special offers these production tested components to users for machines of their own construction.

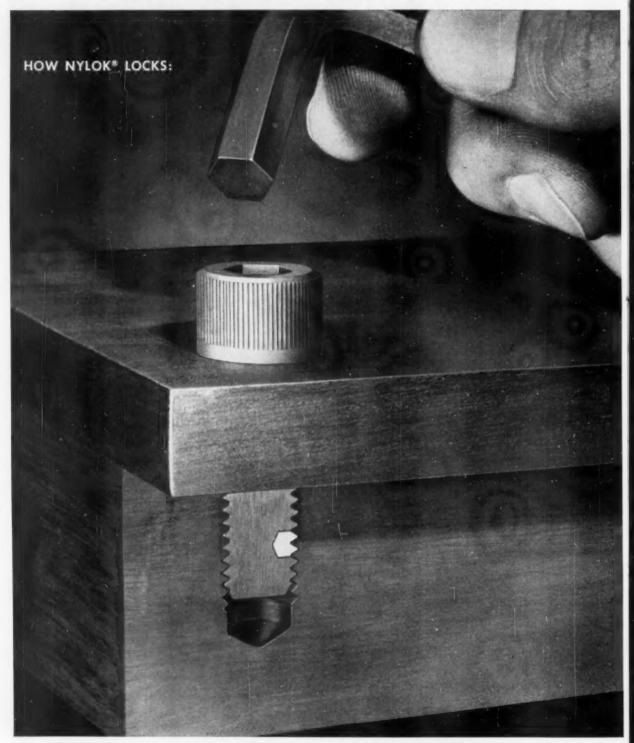
Consult Hartford engineers for either — completely tooled machines or components.



MACHINE TOOL DIVISION
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Hartford also makes automatic Thread Rolling Machines, Special Machinery and the world famous Super-Spacer.

NEW-self-locking UNBRAKO



LOCKED! The tough, resilient nylon pellet keys Itself into the mating threads. It forces threads together and locks the screw securely.

socket head cap screws



Self-locking UNBRAKO socket head cap screw.



BEFORE ASSEMBLY. The nylon pellet projects slightly. When assembled, threads will be impressed into it.



AFTER REMOVAL. "Plastic memory" of pellet has expanded impressed threads to greater diameter than screw threads. Screw can be used repeatedly. In use, "memory" keeps threads tightly locked.

They won't work loose. And they simplify design and save production time.

UNBRAKO socket head cap screws are now available embodying the Nylok* self-locking principle. Nylok provides the first truly practical solution to the problem of making cap screws self-locking.

An Unbrako cap screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the Unbrako into any tapped hole. Seated or not, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not work loose.

You save production time when you make products with self-locking Unbrakos. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. And in many cases you will save weight and mass by using shorter screws in tapped holes instead of drilling through and using nuts and lockwashers.

Self-locking UNBRAKOS are reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, when screws are properly seated, the locking pellet also functions as a liquid seal.

A complete line of self-locking Unbrako socket screw products, in a wide range of standard sizes, materials and finishes, is available through your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 37, Pa.

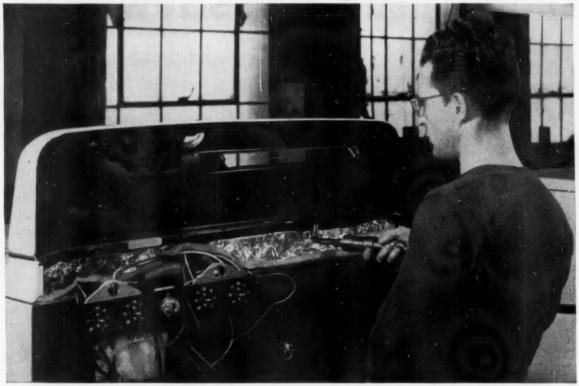
*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.



Gardner-Denver... Serving the World's Basic Industries



Driving hex-head sheet metal screws in confined area of stove with Keller Tool Ratchet Wrench.

Running nuts in close quarters? Then use Keller Tool Air-Powered Ratchet Wrenches

You name it... on heavy machinery or lighter assemblies like this stove, close-quarter nut running is a cinch for a Keller Tool Ratchet Wrench. Wherever the nut location, there is a ratchet wrench or attachment to keep bottlenecks out of assembly operations.

Talk over your problem with a Keller Tool representative. Chances are he can supply a standard ratchet wrench that will turn the trick slick as silk.

Operate anywhere . . . in close quarters . . . hard-to-get-at places. Save skinned knuckles . . . effort.



Adaptor and socket—for hard-to-reach places or cramped positions.



Built-in, extended socket—for reaching behind channels, around corners.



Angle type—for flat on floor or under anloverhang nut setting.

GARDNER-DENVER

KELLER TOOL division, Grand Haven, Michigan

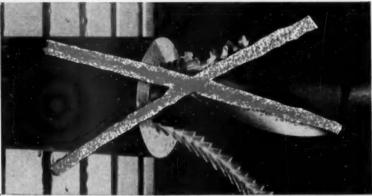
THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY



The Tool Engineer

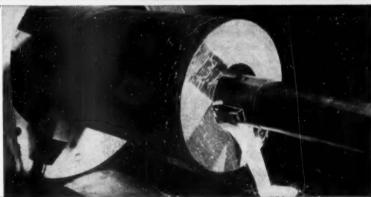
How to save a big step when you make hollow parts...

SKIP drilling bar stock



START

with finish boring of TIMKEN[®] seamless steel tubing



WITH Timken® seamless steel tubing as your base stock, finish boring often is your first production operation in making hollow parts. You save a big step because you don't have to bore out the center hole. It's already there! And because Timken seamless tubing eliminates one boring operation, it frees part of your screw machines for other jobs. Result—you add machining capacity without adding machines.

And figure in this extra saving. With Timken seamless tubing you get more parts per ton of steel. There's less metal to hog out.

Timken Company engineers will study your problem,

recommend the most economical tube size for your hollow parts job—a size guaranteed to clean up to your finished dimensions.

You can get better quality products, too. Manufacture of Timken seamless tubing is basically a forging operation. It produces a uniform spiral grain flow for greater strength—a refined grain structure that brings out the best in the metal's quality. And this quality is uniformly maintained from tube to tube, heat to heat, order to order. Our metallurgists will gladly work with you, show you where Timken seamless steel tubing can save you money. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO."

TIMKEN

Fine Alloy STEEL

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

November 1956

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271

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MULTIPRESS

... THAT NEEDS A PRESS NOW

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High-speed production tool

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MULTIPRESS

- Gives up to 750 ram strokes per minute.
- Ram pressures adjustable up to 1-ton.
- Automatic pressure reversal.
- Completely self contained.
- · Your present tooling easily adaptable.
- Dual manual safety control.

only \$395<u>00</u>

F.O.B. Factory. Subject to prior sale



CUTS YOUR TOOLING COSTS ON SMALL AND LARGE QUANTITY LOTS—Many shop operations can be simplified because you can move Multipress quickly and easily from department to department, wherever a press is needed. And, because Multipress can be moved around, it can be stored in your tool crib complete with tooling senup until the particular production job is run again.



SIMPLIFIES AUTOMATIC OPERATIONS - Multipress is specially engineered for automation. It can be mounted simply around dial tables and indexing fixtures to keep your tooling costs to an absolute minimum. The Multipress controls can be actuated electrically, pneumatically or hydraulically from external sources making it easy to interlock the Multipress in with other automatic production operations.



IDEAL FOR CONTINUOUS LINE PRODUCTION—Two or more Multipress units can be easily set up side by side to handle straight line production work. Surprisingly small bench area is needed for line production work because of the compact, operator-engineered design developed in the 1-ton Multipress.



DENISON ENGINEERING DIVISION

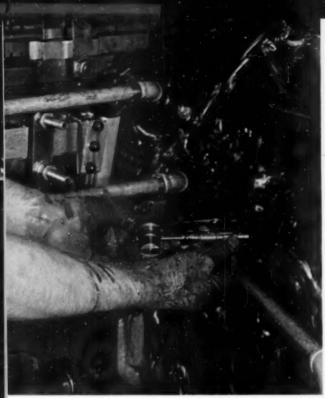
American Brake Shoe Co.

1182 Dublin Road

Columbus 16, Ohio

DENISON

Hydrollica





Black cutting cil (left) makes close control difficult. Operators dislike dirty operating conditions it creates. Close control is easier and workers are happier with transparent Sunicut cutting oil (right).

WHY USE A BLACK CUTTING OIL WHEN YOU DON'T NEED IT?

Sunicut oils give you better visibility without sacrificing machining efficiency.

When trying to maintain close control over machines producing precision parts, operators can be handicapped by "black-oil blindness". It is hard to see the tools, the workpiece, and the finishes. Checking close tolerances is difficult when the graduations on micrometers and gauges are obscured.

Worse still, as the operator sees it, are the dirty working conditions caused by dark oils. His clothes get saturated with hard-to-remove stains, and his hands are black from one end of the shift to the other.

Transparent Sunicut oils help keep your operators happy and will make close control easier ... and transparent Sunicut oils will do the job with no sacrifice in machining speed or finishes.

To get the full story on Sunicut oils, see your local Sun representative, or write Sun Oil Company, Philadelphia 3, Pa., Dept. I-41.



INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

IN CANADA: SUN OIL COMPANY LIMITED TORONTO AND MONTREAL



For any machining or grinding operation ...

THERE'S A SUN OIL THAT'LL GIVE YOU HIGH EFFICIENCY AND LOW OVER-ALL COST

No two machine shops have exactly the same problems when it comes to selecting cutting oils...even when they're running the same job. And, until somebody comes up with the truly universal cutting oil, you can't afford to disregard the importance of oil selection. Here's how Sun can help you.

First, Sun makes a complete line of emulsifying and straight cutting and grinding oils. Second, your Sun representative, backed up by field engineers, has the necessary practical experience to recommend

the oil that will give you both high machining efficiency and low over-all costs.

For the full story about Sun's cutting oils, see your Sun representative...or write Sun Oil Company, Philadelphia 3, Pa., Dept. I-42.



INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

NOW! VAR Carbide Inserts

in the New Engineered Plastic Package ...



Saves space saves time—Inserts are visible through package for quick inventory.

A complete line of standard throw-away inserts . . . triangular, round and square—all packaged in V-R's exclusive new transparent plastic containers.



away carbide inserts. Here are the advantages:

Easy To Remove Inserts For Inspection Or Use-no fumbling -no dropping-and the insert goes right back into the partitioned container.

Easy To Take inventory—just turn the package over and look through the transparent bottom.

Instant Identification—insert style, carbide grade and quantity are clearly stamped on package label. Carbide grade is designated on each insert and visible through package. Maximum Carbide Protection-chances of dropping, chipping or breaking carbide are reduced to an absolute minimum. Package is rigid and durable. Inserts never touch each other. Easy To Store -takes less drawer or shelf space and is easier

to store and handle than any insert package ever before devised.

Here is the convenient, time and money-saving package for the finest quality carbide inserts you can buy. Order your V-R inserts today. Call your local V-R Representative or Distributor, or write:



878 Market Street • Waukegan, Illinois

MANUFACTURERS OF CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS

November 1956



Precision duplicating of multiple diameters, tapers, bevels, shoulders, radii, grooves, chamfers

With this new CLAUSING you can . . . do automatic between-center reproduction of intricate patterns in a fraction of the time formerly required • eliminate repetitive measurements, multiple tool set-ups, expensive forming tools • impart a smooth, stepless finish • provide automatic sizing • reduce chance for human error • practically eliminate scrap.

FOR SHORT RUN AS WELL AS VOLUME PRODUCTION — short runs can be done economically because set-up and tool changes can be made in minutes. Savings on long runs are phenomenal.

HANDLES WORK up to 12" diameter, 2½" diameter differential, 18" length. Hydraulic cylinder housed in Servo motor provides power to firmly drive and hold cutting tool. Slide feed, in and out, infinitely variable from 0 to 15" per minute. All critical parts of tracer unit hardened, ground and machine lapped. Bed ways of lathe are flame hardened, ground. Variable speed drive from 43 to 222 and 250 to 1300 RPM, adjustable while running. Completely enclosed head stock, quick-change box, apron . . . oil bath lubrication. Spindle turns on big Timken "Zero Precision" tapered roller bearings.



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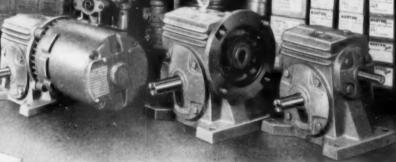
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56BG-NC-25A

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.0002 T.I.R. OR LESS AT SPINDLE NOSE, .0005 T.I.R. OR LESS ON TEST ARBOR SIX INCHES FROM SPINDLE NOSE



The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B & S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

K. O. LEE COMPANY

ABERDEEN, SOUTH DAKOTA

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gages holes 1/4" to 10" diameter to fractions of .0001"

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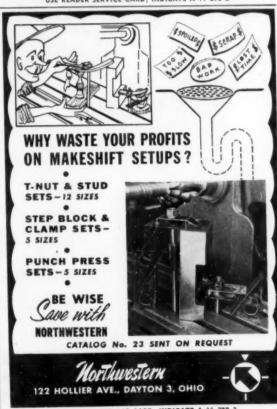
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USE READER SERVICE CARD: INDICATE A-11-278-2





USE READER SERVICE CARD; INDICATE A-11-278-3

You change only the throw-away insert ... not the cutter body



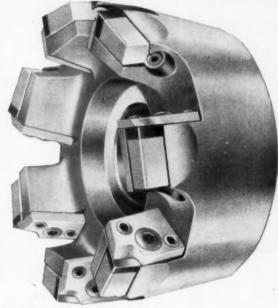
WITH NEW V-R PURPOSE FACE MILL CUTTERS

- Save downtime . . .
- Reduce lost production . . .
- Eliminate carbide grinding . . .
- Reduce carbide costs



You get eight cutting edges with each V-R square carbide insert. Replacement and indexing takes but seconds, thanks to V-R's exclusive design. The single main screw controls the elevator which clamps the insert against the chipbreaker plate. A recessed socket in each end of the main screw makes insert replacement fast and easy, regardless of the position of the cutter. There is nothing to fall out, nothing to fumble with.

All parts are replaceable and interchangeable.



Inserts are Inexpensive . . . Lost Production is Costly

You do not remove the cutter body when cutting edges are worn in V-R's rugged new all-purpose Face Mill Cutter. Precision ground square V-R carbide throw-away inserts index perfectly just by slipping them in position and tightening the main screw. When using a negative rake cutter, you get eight cutting edges on every insert. When the inexpensive inserts are used up, throw them away and replace with new ones.

V-R Face Mill Cutters reduce downtime, completely eliminate carbide grinding and save money. They are available in 4", 6", 8" and 10" standard sizes. Other sizes available to meet your requirements.

Ask for new Bulletin for complete information.

Call your local V-R Representative or Distributor, or write:

A

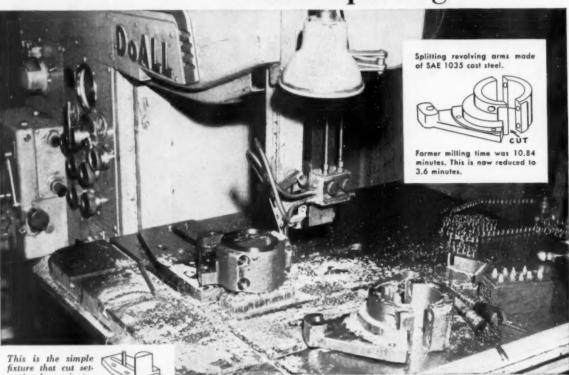
MANUFACTURERS OF:
CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS

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How Production Band Machining Cuts Splitting Costs







This is the Contour-matic which doubled production with a carbon steel blade.

Faster Cutting and Reduced Setup Time **Increase Production**

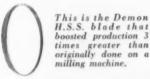
Literally thousands of splitting operations now being performed by other methods can be done at lower costs with DoALL production band machines.

For example, at one company, the number of "revolving arms" split in an 8-hour day jumped from 44 to 84 when band machining replaced the previous machining method ... and when Demon high-speed steel blade was used instead of carbon steel saw band, production rose to 133 a day. Accuracy and finish were excellent, well within tolerances.

The inexpensive, exceedingly simple fixture used is typical of those required for band machining. Hold-down elements are unnecessary as the work is clamped to the table by the downward cutting force of the blade. DoALL offers a complete band machine fixturing service and provides design sketches free of charge.

If you do production splitting and slotting, it will pay you to call your local DoALL Sales-Service for a free demonstration in your plant, or write:

THE DOALL COMPANY, Des Plaines, Illinois



FREE LITERATURE AND MOVIES-The new 16-page saw band catalog and the new contour-matic catalog are now available as well as two sound-color movies for group showings—"Production Band Ma-chining" (30 min.), and "Production Tooling" (10



Friendly DoALL Sales-Service Stores in 38 cities-call yours







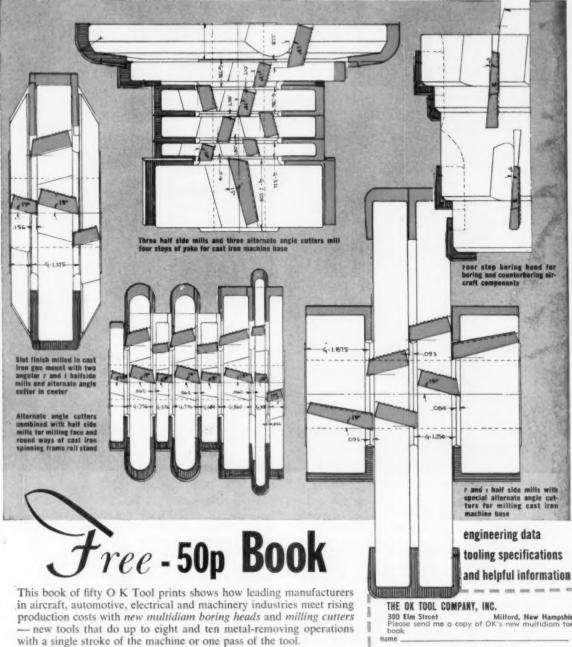








PB-30



Special heads bore and face at four levels, chamfer some holes, all in a few minutes. Savings in man hours and machine time can be reduced to one-sixth of the previous cost.

Fresh from the press and now released for the first time, this book is an inspiration to engineers, designers, methods and production men. IT'S FREE!



modern milling cutters for modern milling machines

The O K Tool Company, Inc., 300 Elm Street, Milford, N. H.

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title	
firm	
street	
city	state
products manufactured	
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Equipment: how many boring	mille
milling machines	lathes

For the King and Queen of Extrusion Presses ... it's FIRTH STERLING HOT WORK DIE STEEL



2500 lb. die blanks and a finished extrusion die of Firth Sterling HWD Hot Work Die Steel.

At Kaiser Aluminum & Chemical Corporation's Halethorpe Extrusion Works, operated under a U. S. Air Force lease, are two 8,000 ton capacity extrusion presses—the largest operating units designed and built in the United States. Presently extruding large, complex aluminum shapes—wing spars, wing panel sections, and missile hull sections, for the aircraft industry, the two giant presses, named Rex and Regina, utilize dies made from Firth Sterling Hot Work Die Steel.

Yes, Firth Sterling HWD is a monarch in its own right, with properties capable of withstanding the tremendous pressures of this king and queen of extrusion presses. This intricate process requires materials that can operate continuously in volume production without replacement. These giant presses each weigh 1500 tons and are capable of extruding aluminum shapes more than 85 feet long and over 1200 pounds each in weight. The use of Firth Sterling HWD is tangible evidence of the high opinion modern die makers have of the quality of the material.

HWD Steel is just one of the Firth Sterling line of more than 50 Tool and Die Steels. Ask for a Firth Sterling engineer to cooperate in your next die making problem to assure the correct grade and analysis.

Firth Sterling

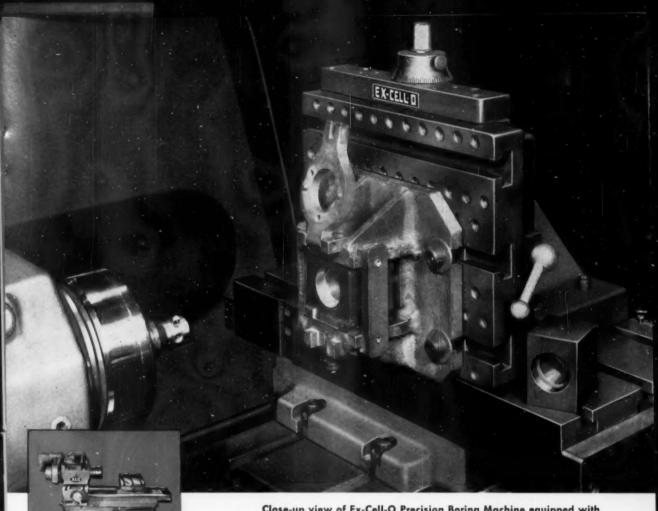
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Close-up view of Ex-Cell-O Precision Boring Machine equipped with a single spindle and a universal fixture for small lot production.

These versatile machines keep busy

Ideal machines for toolroom work and short production runs

These Ex-Cell-O Precision Boring Machines equipped for general-purpose work perform precision boring, turning, facing and chamfering operations quickly and economically.

They can be operated automatically or manually. Spindle speeds are easily changed to suit the operation. Universal fixture rigidly holds tools and work pieces of many sizes and shapes. Horizontal and vertical slides of the fixture permit precision positioning of either tools or work.

A complete line of precision boring machines is available. For information just call your Ex-Cell-O representative or write Ex-Cell-O in Detroit.

EX-CELL-0 FOR PRECISION

DETROIT 32. MICHIGAN MANUFACTURERS OF PRECISION MACHINE TOOLS . GRINDING SPINDLES . CUTTING TOOLS RAILROAD PINS AND BUSHINGS . DRILL JIG BUSHINGS . AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS . DAIRY EQUIPMENT

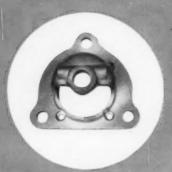
2112-B single-end **Ex-Cell-O** Precision Boring Machine

with horizontal cross slide fixture.

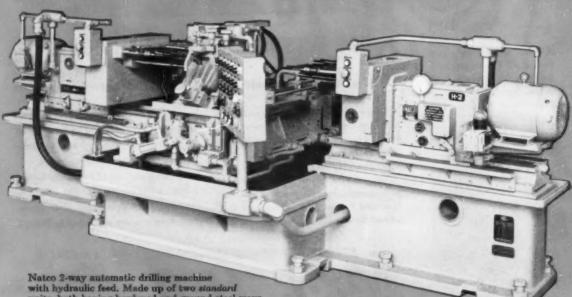
1212-B double-end

Ex-Cell-O Precision Boring Machine with universal fixture having cross and vertical slides.

Natco Standard Units Perform Special **Jobs**







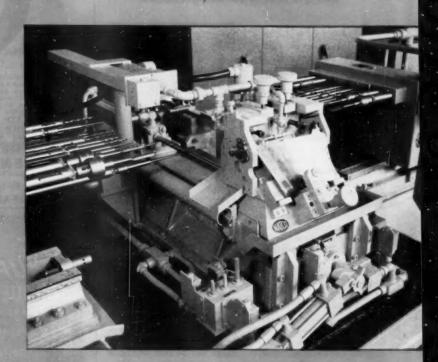
Nateo 2-way automatic drilling machine with hydraulic feed. Made up of two standard units, both having hardened and ground steel ways, automatic lubrication, automatic time delay and positive stop.

Many special jobs can become routine with Natco's standard unit design. Take these parts, for instance. Unique parts presenting unique problems. Natco solved them by using standard horizontal, self-contained Holeunits with automatic fixtures.

Varied operations are performed—production to meet customer's requirements.

Natco's use of standard units can mean quicker delivery and lower price to you. Call a Natco Field Engineer to determine whether Natco's standard unit design can solve your "special" problems.





Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan.

NATIONAL AUTOMATIC TOOL COMPANY, INC.

Richmond, Indiana

Multiple-spindle drilling, boring, facing and tapping machines. Special machines for automatic production. NATCO

Call Natco offices in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles; distributors in other cities.

Cut Inspection Costs

by employing the added accuracy and speed of a

NIKON

Optical Comparator

Permits the study and measurement of surface textures as well as edge contours

A Nikon Optical Comparator permits critical examination of small objects, by projecting their magnified images onto a viewing screen. Because the magnifications are precise, the dimensions of the object can be readily derived from measurements taken of the projected image.

For example, a precise enlarged contour pattern on a translucent sheet, placed onto the viewing screen, can serve to define the tolerance limits of an object or part under inspection. Several critical points can be checked simultaneously. Errors in judgment are virtually eliminated. The most intricate contours, and minute parts, are easily gaged by this technique.

Surface Illumination

One of the important features of the Nikon Optical Comparator is the added facility for surface illumination. This permits the surface topography of any material to be closely examined—for texture, finish, corrosion, wear, etc.

Nikon Optical Comparators are equipped with lens turrets—which permit rapid interchange to selected magnifications—and with fixed adjustment positions for condensers, to provide maximum illumination efficiency at each magnification.

Bright, Even Illumination

Most impressive in the performance of the Nikon Optical Comparators are the extreme accuracy, the overall sharpness of the projected viewing image, and the even brightness of illumination. These are functions of optics, a field in which Nikon has already demonstrated outstanding achievements in the development of new optical glass techniques, photographic lenses, prism binoculars, ophthalmic and other scientific instruments.

Another attractive advantage of the Nikon Optical Comparators is their surprisingly low cost.

Nikon Bench Model Comparators are also available

For specifications and prices, write to: ZL-20

NIKON INCORPORATED 251 Fourth Avenue, New York 10, N.Y.

Stereo and Research Microscopes, Surveyor's Transits and other precision optical equipment USE READER SERVICE CARD; INDICATE A-11-286-1





7 WAYS to SAVE MONEY w

TOCCO* Induction Brazing

\$15.84 per hour was saved by Jack & Heintz when they switched from torch brazing to automatic induction brazing of these inverter brush mounts. TOCCO brazing also upped production from 40 to 360 brazed assemblies per hour.

silver-solder ring Production was doubled and cost cut 50% when Commercial Shearing and Stamping Company changed from welding to TOCCO induction brazing of these hydraulic cylinder assemblies. Heating time was cut from 15.3 minutes to 2 minutes on 51/4" cylinder shown here.

Willey's Carbide Tool Co. cut cost of brazing tips on large lathe tools from 58¢ to 4¢ when they adopted TOCCO induction brazing. Production is 8 times as fast with TOCCO-85 per hour, against 80 per day produced by a former method.



Formerly, Norris Thermador Corporation used arc welding to join this bushing and clamp. The change to

TOCCO induction brazing reduced their costs 32% -from \$46.44 to \$31.73 per thousand parts.

> When Mechanics Universal Joint Division of Borg-Warner shifted from welding to TOCCO induction brazing of this drive shaft assembly, they reduced the cost of the operation 67%. At the same time automatic TOCCO increased production from 11 to 45 pieces per hour-400% faster than the former method.

Packard engineers saved \$1.74 per part when this automatic transmission shaft was redesigned from a forging to a steel shaft and casting, permitting the use of TOCCO induction brazing. In addition to this per part saving, \$74,325 was saved in equipment and tooling.

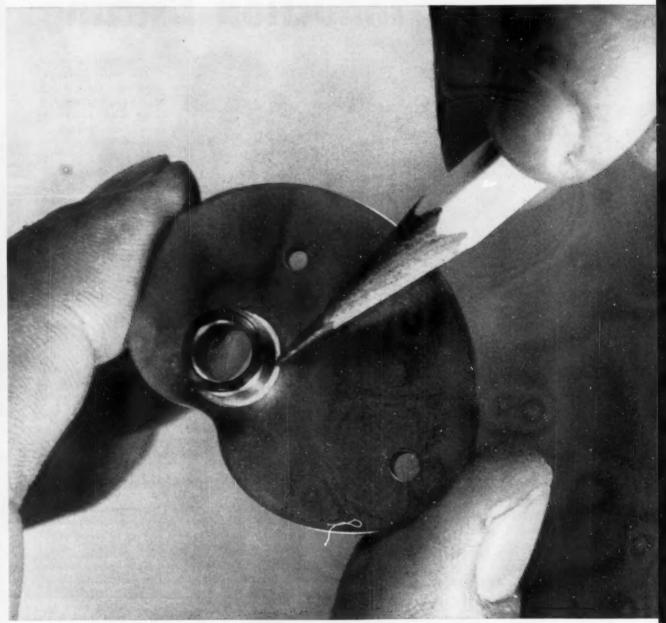


Number 7-the lucky number-is up to you. Why not add your name to the list of companies who use TOCCO Induction Heating to increase production, improve products and lower costs. TOCCO engineers are ready to survey your plant for smililarly money-saving results-without obligation, of course.

THE OHIO CRANKSHAFT COMPANY	NEW FREE THE OHIO CRANKSHAFT CO. BULLETIN Dept. G-11, Cleveland 5, Ohio
TOCI	Please send copy of "Typical Results of TOCCO Induction Brazing and Soldering." Name Position Company Address City Zone State

Another Opportunity Chemical...

Versamid-based adhesive economically, eliminating



VERSAMID-BASED ADHESIVE REPLACED SOFT SOLDER to assemble this stronger radio receiver cam—cutting costs 47 & per unit, increasing production from 25 to 500 units per hour,

and practically eliminating scrap loss. These adhesives resist severe environmental conditions, mechanical shock, impact force—are easily prepared for use without need of solvents.

Investigate Versamids the versatile polyamide resins made only by...

CHEMICAL DIVISION

joined these piece-parts soldering and welding



VERSAMID-BASED ADHESIVE IS QUICKLY, EASILY APPLIED to the stainless steel hub with the aid of a gun and rotating holding fixture. When the second brass cam is pressed on, it picks up enough adhesive to bond the two parts permanently-saving time, labor, expense!



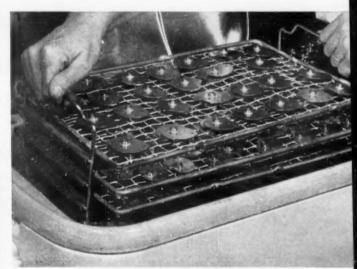
VERSAMID-BASED ADHESIVE HAS LONG POT LIFE, providing ample time for aligning hub (adhesive-carrying side down) with second cam before setting-up. When the two are pressed together, the assembly is ready for cure.

Take two pieces of almost any like or unlike materials to be joined, apply a dab of adhesive formulated from Versamid polyamide resin, press together—in minutes the bond is completed. It's that simple, that fast. And in most cases, the bond is stronger than the materials joined.

Shock-resistant, tenacious adhesives made of General Mills Versamid polyamide resins are used successfully in a growing list of industries to bond any combination of metals, glass, plastics, wood, ceramic, concrete, leather - almost any material normally requiring costly, time-consuming soldering, welding, riveting or sewing.

Streamline your production by using Versamidbased adhesives to build better products with stronger seams and joints-at far less cost!

General Mills does not make these superior adhesives ... only the Versamid polyamide resins that make them possible.



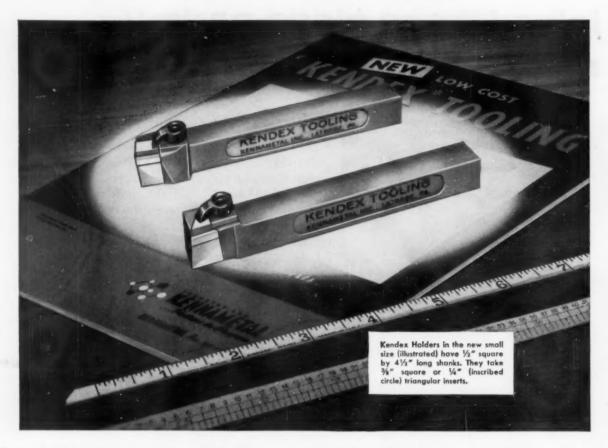
VERSAMID-BASED ADHESIVE CURES AT ROOM TEMPERATURE, but to hasten the process, mild heat can be applied. Removed from the oven, cams are finished. If soldered, they would need hours of extra work to correct warpage caused by 450° C soldering heat.

of General Mills KANKAKEE. ILLINOIS

General Mills is a dependable source of supply for these organic chemicals:

- · Fatty Acids
- · Versamid
- · Methyl Esters of Fatty Acids . Sterols
- Polyamide Resins

- · Fatty Nitrogens · Tall Oils



NOW, small Kendex Button Tools with turnover "throw-away" inserts

...for light machining on high production operations ...especially useful for boring operations

Another variation of the popular Kendex Tooling is now available. This is the new ½" Kendex Holder, available in four styles, for use with triangular or square Kennametal* "turn-over" button inserts... making available small tools with the many advantages and economies of the Kendex principle:

- grinding is eliminated
- inserts are indexed quickly to each new cutting edge
- · machine downtime is reduced to a minimum
- · production is increased

If you are interested in small-sized, rugged, dependable clampedtype tooling, ask your Kennametal tool engineer to show you how these small Kendex holders can be used to advantage on your operations. Or write for Booklet 301. Kennametal Inc., Latrobe, Pennsylvania.

*Registered Trademark

Small-sized Kendex Tools are equipped with Kennametal chip breakers and solid Kennametal seats to back up inserts.

Kennametal inserts for small Kendex holders are stocked in a number of grades including the new K7H grade for high velocity operations and for machining heat-treated or high tensile steels.

Tell us your small-tool problem and our tool engineers will help you select the right tool and grade of cutting edge.





KENNAMETAL
...Partners in Progress





A COMPLETE LINE FOR GREATER CLAMPING SECURITY

You can rely on this team for big production gains in your press room. Danly Bolster Plate Accessories provide new versatility and efficiency. For example Danly's new clamping method is designed to give greater clamping security... far more clearance. Clamps are constructed with extensions that fit into standard drilled holes in the die holder. This assures maximum clearance for stock feeding and eliminates the need for clamping flanges. Through standardization of clamping holes, these clamps can be used with die holders of varying thickness. Ideal for use in the press room, they are available in sizes for ¾-inch and 1-inch T-slots.

All Bolster Plate Accessories are manufactured to Danly's traditional quality standards. Write for your copy of our complete catalog of Danly Bolster Plate Accessories...lists every item generally needed in die shop, tool room or press room.



DANLY MACHINE SPECIALTIES, INC. 2100 South Laramie Avenue Chicago 50, Illinois

Hollow Mill Maker finds





Write For Copy of "CUTTING TOOL MATERIALS"

This 36-page illustrated booklet analyzes and compares types and covers grade selection for all major classes of cutting tools, etc., invaluable data for production men. Write for your copy today.

Address Dept. TE-83

The maker of these adjustable hollow mills required a steel that would give top performance in a variety of jobs—turning, tapering, facing, chamfering and trepanning. After thorough testing, Allegheny Ludlum's high speed DBL-2 was selected.

DBL-2 is an improved general-purpose high speed steel. It contains tungsten, molybdenum and vanadium in such proportions that it excels 18-4-1 for most applications. DBL-2's unusual combination of high hardness with toughness, its ability to hold a fine grain over a wide hardening range, and the fact that it easily machines many diverse types of stock, made it particularly well suited for this job.

In addition to these advantages, DBL-2 can be heat treated in the same furnaces and atmospheres as 18-4-1 without fear of harmful decarburization. These DBL-2 blades were heated to 2250 F., oil quenched and drawn twice at 1025 F. After heat treatment, blades easily machined such stock as aluminum, stainless steel, carbon steel, aircraft steel, plastics, bronze, screw stock, cast iron and brass.

There is an A-L tool steel to meet your toughest requirements. Call your A-L representative or distributor today . . . or write Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania.

For complete MODERN Tooling, call Allegheny Ludlum





.00005" BETWEEN ANY TWO POINTS IN 12" RANGE

Cadillac PLA-CHEK

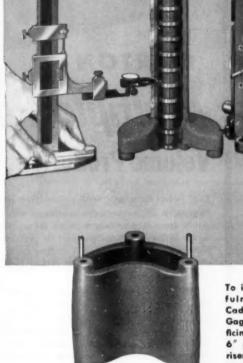
SPEEDS ACCURATE INSPECTION from MINUTES to SECONDS

Designed for easy portability and extreme ruggedness, this 12" Cadillac PLA-CHEK takes little more than 10 seconds to set! Permits surface plate checking and inspections nearly 5 times faster than by ordinary methods.

And, accuracy is assured! Between any 2 points in the 12" range accuracy is guaranteed within .00005".

With a reverse checking plate, a heightgage indicator is easily set for checking the underside of parts. Use of inside micrometers, telescoping and internal cylinder gages gives this gage added versatility. Send coupon TODAY for complete details!

Cadillac



To increase the usefulness of the 12" Cadillac PLA-CHEK Gage, without sacrificing portability, this 6" precision-made riser may be used upping range to 18".

MAIL THIS COUPON FOR COMPLETE DATA

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on the Cadillac PLA-CHEK Gage line to:

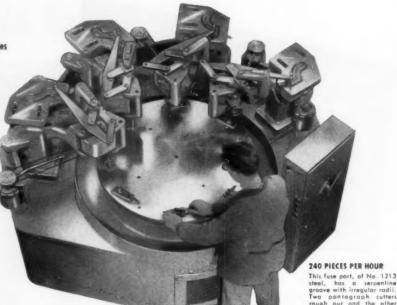
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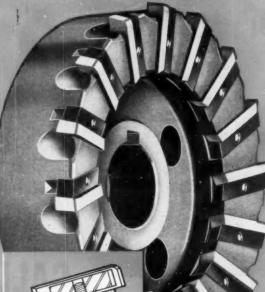




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As reported by Mr. Arnold Thompson, President, Thompson Tool and Manufacturing Company, Franklin, Ill., manufacturers of the "Dress-O-Grind" grinding flature.

When thread chasing failed to provide the required finish for this Class 3 thread fit air rotor—and thread grinding proved too costly—this manufacturer turned to thread rolling, using the versatile new N-2 Acme-Fette Self-opening Thread Rolling Head, on a hand screw machine.

"As a result," states Mr. Thompson, "on a test run of only 1000 pieces, our threading cost dropped from 50 cents to one cent per piece... and we maintained the finish we had to have throughout the run, without a single adjustment."

While the Acme-Fette Thread Rolling Head has built its reputation on long runs (often running into the millions) don't overlook the many advantages it offers—even on short runs!

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Tool Steel Topics



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Esperi Distributura



Bearcat Puts the Eye in Eye Bolt ... And Does It Economically

Putting the eye in an eye bolt is one thing, but doing it quickly, accurately and economically on thousands of pieces is something else again. J. H. Williams & Co., Buffado, who make wrenches, tools and drop-forgings, changed to Beareat for the punching operation shown here. They found that because of Beareat's fine wear-resistance and shock-resistance, the punch provided a service life about



50 pet longer than the one previously used.

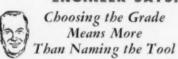
The Bearcat punch, hardened to Rockwell C 56-58, works on steel stock V_8 in. and 5/16 in. thick, and knocks out discs approximately $^{3}\!\!\!/_4$ in. in diameter. About 0.020 in. to 0.040 in. is removed in occasional redressing.

Beareat is our super-tough, airhardening, general-purpose grade of tool steel. It is perhaps best known for its exceptional resistance to shock and wear. Besides, its air-hardening characteristic minimizes quenching hazards, and also provides excellent resistance to distortion in heat-treatment.

Bearcat has a wide range of tough applications, too. In addition to its use in punches, it's a natural for rivet sets, chisels, gripper dies and hot-headers. It is also ideal for master hobs, and for dies used in blanking, bending, and cold-forming.

Your local tool steel distributor has a stock of Bearcat, and chances are good that he can furnish exactly what you need. Call him now, while you have it in mind.

BETHLEHEM TOOL STEEL ENGINEER SAYS:



Let's say you have a general tool-and-die application, for which you are to select the proper grade of tool steel. How do you go about it? Obviously, it is not enough to know that the customer wants high hardness and good wear-resistance, for these properties are always required, in some degree. What you need are the answers to the following questions:

- 1. How is the tool to be made?
- 2. How is it to be used? Blanking? Forming? Cutting?
- 3. How is the steel to be heat-treated?
- 4. Are machinability and wear-resistance important?
- How close must size be held after heattreatment?
- 6. What is the previous experience with this job? Which steels were used and what results were obtained?

Selecting tool steel grades, even when you want perfection of operation, isn't too hard when sufficient data is available. But without adequate information, you may find your selection is disappointing.



TOOL STEEL MOVIE WINS ANOTHER AWARD

Bethlehem's tool steel color movie, "Teamwork," an award winner at film festivals at Columbus and Chicago, recently won a Certificate of Merit at the Cleveland Film Festival.

The 16-mm, 30-minute picture explains the quality control and heat-treatment of Bethlehem tool steel, and shows typical applications of the carbon, oiland air-hardening, shock-resisting, hotwork, and high-speed grades.

It's excellent for showing to heattreaters, die-makers, machinists and machine-tool manufacturers, as well as to technical societies and engineering students. If you would like to schedule a showing of "Teamwork," send your request to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.



COMMENT AT THE METAL SHOW!

This is the

Forgive us the informality of our headline. A lot of people at the Metal Show made this comment so we use it instead of the conventional superlatives.

A completely new furnace
 No elements, no burners, no electric or gas connections
 in it
 Circular shape reduces temperature losses, saves floor space
 Greatly lowered maintenance costs
 More accurate temperature control
 Quiet, automatic, fool-proof.

There just never has been a heat treating furnace like this new Lindberg Induct-O-Ring. Radically different, it has no elements, element terminals, burners, electric or gas connections in the furnace proper. The chamber, lined with a heat-resistant alloy muffle and deeply insulated, is heated by induction. All the heat is in the chamber and the work load.

Heating efficiency is high and the heating rate spectacular, with hardening temperatures reached in 17 minutes from cold. Temperature control is highly accurate and precise and temperature override and lag is eliminated for all practical purposes.

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The Induct-O-Ring's circular shape eliminates door-opening heat and atmosphere losses and saves floor space. Actually, it is possible to have 30 feet of furnace length in a 5 foot diameter unit. Operation of the furnace is extremely simple. Work load is automatically charged and moved through the work chamber by a gentle reciprocating movement of the entire furnace. Work is then automatically discharged into quench tank.

The Induct-O-Ring is built like a fine machine tool. Sealed ball bearings support the moving parts of the furnace. Quench tank, quench conveyor, circulation and cooling of the quench are all self-contained.

The furnace is completely adaptable to automated production processes where its precise heat control, negligible maintenance, and dependable operation are of particular importance.

We are sure that the Induct-O-Ring offers an entirely new concept in heat treating efficiency and economy. You can very easily find out how it can be used in your production processes. Just call your nearest Lindberg Field Representative (consult your classified phone book).



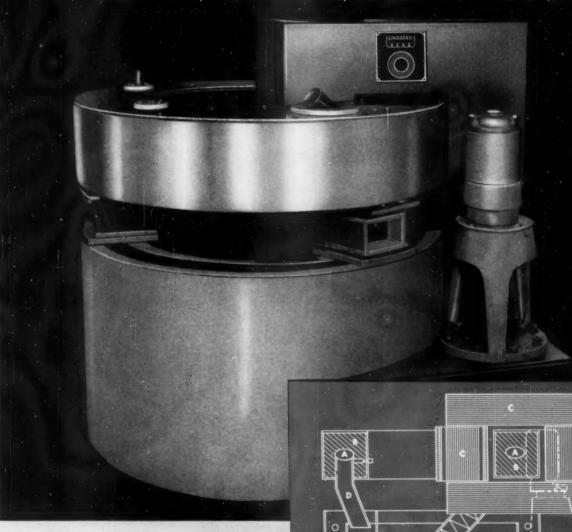
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AN OPEN INVITATION TO AUTHORS

An invitation for technical papers has been extended by the National Program Committee of the American Society of by the National Program Committee of the American Society of Tool Engineers. The papers are for presentation at the 26th Annual Convention of the ASTE, being held in April 1958.

ASTE membership is <u>not</u> required for submission of a paper. Additional papers will be accepted for consideration paper. Additional papers should include an outline until May 1, 1957. Each proposal should include an of the paper, the author's name, title and affiliation.

Authors must also agree to abide by the published rules for presentation of papers before a national meeting of the ASTE.

Outlines should be sent to:

L. S. Fletcher American Society of Tool Engineers Program Director 10700 Puritan Avenue Detroit 38, Michigan

Authors of accepted papers will be notified by June 15, 1957.

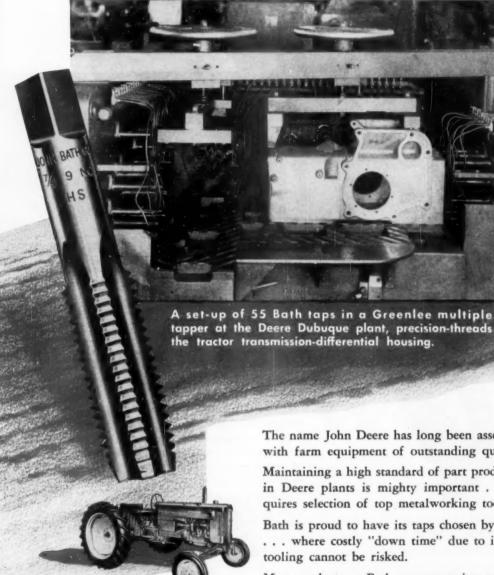
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Automatic Micrometer comparators, Carson-Dice instruments are direct measuring devices. They do not require a known standard, exert no pressure and therefor eliminate "feel" as a source of error with resilient materials. Model W. pictured above and three other models are specially designed for a wide variety of measuring applications in metals, paper, cellophane, plastics, diaphragm, radio and television and many other industries. All models are fully described in Free bul-

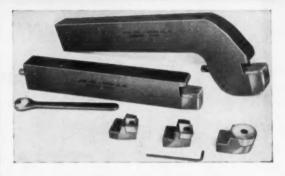
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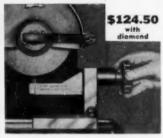


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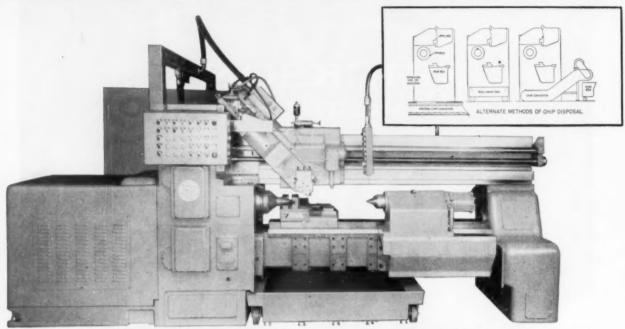
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The line drawing shows a machining operation on the stem end of a rear axle shaft which is rough turned with multiple tools on a rear carriage while finish turning is done with single, tracer-controlled tools on each of the two overarm carriages. Thus the advantages of multiple tooling for stock removal and single tool tracer turning for accurate finish operations are combined. By this method extremely close tolerances are maintained since the pressure of the single tool is constant over the entire length of the work piece, and full advantage can be taken of the higher cutting speeds now possible with the newer carbide and oxide tool materials.

The machining operation is completely automatic... the operator loads shafts between centers and pushes the starting button; multiple tools rough turn; tracer tools then finish turn; and finally the machine stops with all tools returned to starting position.

A similar type lathe is used for the flange turning operation. Varying application of multiple tooling or single tracers to either rear or overarm carriages is possible on these lathes and complete "in line" automation can be engineered to specific production requirements,

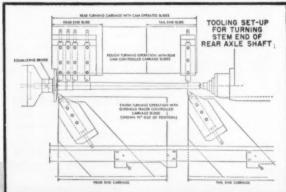
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Write for Bulletin Q-56-C

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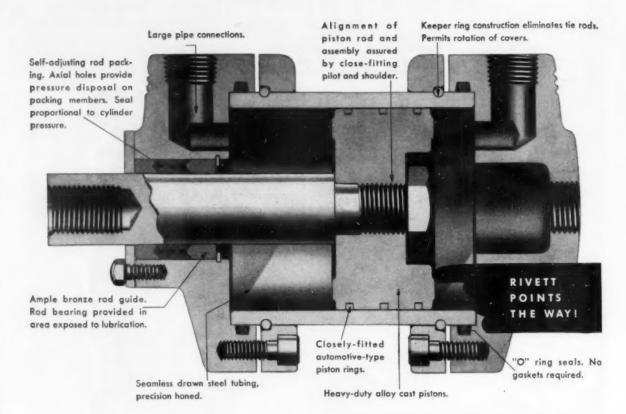
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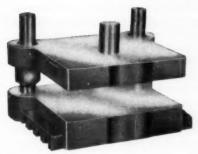


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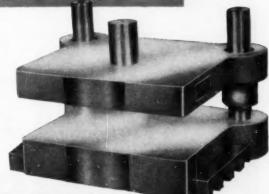
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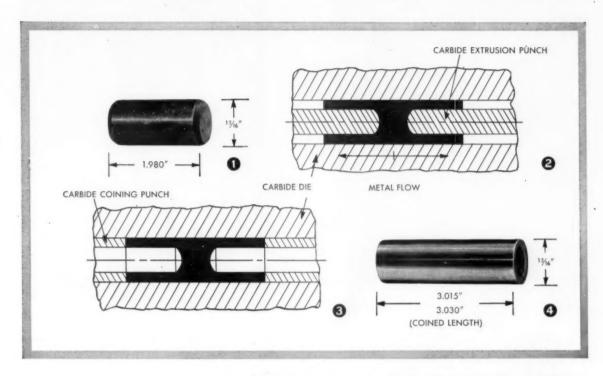
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Westinghouse FIRST IN SATOMIC POWER Increased output, material savings, and improved strength are accomplished . . .

Ford Motor Company cold-extrudes steel wrist pins with Carboloy dies



Solid steel slug (1) is cold extruded by opposed carbide punches (2) into correct shape. Carbide coining punches (3) size the pin to correct length, holding 0.015" tolerances. Finished pin (4) has the same volume of metal as the original slug. Only metal loss is in finish-grinding operation.

Almost 2000 two-inch steel slugs are cold extruded into three-inch wrist pins every hour at Ford Motor Company's new Cleveland engine plant.

The eight-station die holding the work, and the punches that extrude and coin the pin, are made of Carboloy* cemented carbide. By cold extruding with carbide dies, Ford has gained these important cost and product advantages: stronger, better parts, made from a low carbon, low alloy steel, with no scrap loss from machining . . . produced far faster than possible by machining.

Cold extrusion with carbide dies and punches can bring these and other benefits to many metalworking companies. Carbide engineers, with years of experience on cold-extrusion problems, are available to help work out specific applications.

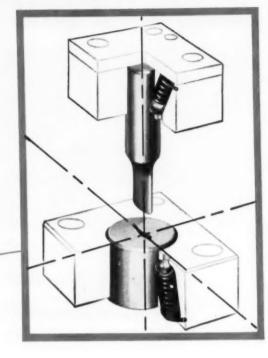
To find out if cold extrusion with Carboloy cemented carbide dies is feasible for your application, check with your diemaker, or send your specifications to: Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Road, Detroit 32, Michigan.

CARBOLOY

CEMENTED CAPRIDES

*"CARBOLOY" IS A TRADEMARK OF GENERAL ELECTRIC COMPANY

R-B Punches are easier to use



Just a push, a twist, and "click" your R-B punch or die button is accurately ALIGNED and LOCKED in place. The R-B ball lock prevents radial or vertical movement of the punch or die button in the retainer—no additional keying is required. R-B punches and die buttons are just as easy to remove—simply insert tanged tool in retainer hole to release ball lock. Standardized and completely interchangeable in any shape or size, these easy to use punches and die buttons save your time and energy.

No other manufacturer of punches and die buttons can offer you the amount of successful application experience and the scope of knowledge that is available from the R-B engineering staff for:

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Reducing Die Designing Time

*-Increasing Productivity of Presses

* Supplying Answers to Piercing Problems

* Saving Die Construction Time

* Complete Standardization of Press Tooling

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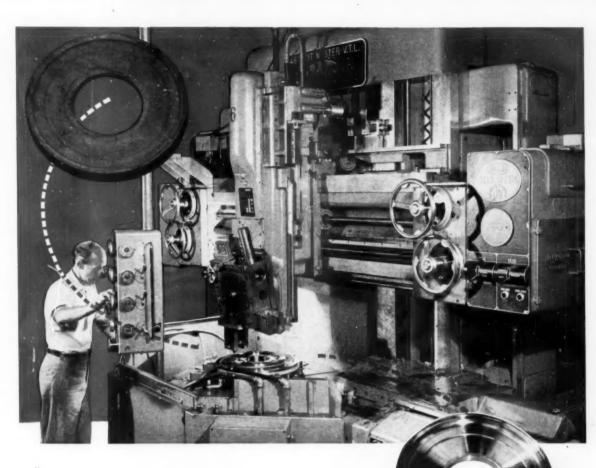


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ALLIED PRODUCTS CORPORATION

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To produce quality parts in quantity .

Nothing beats Man-Au-Trol

This statement by Mr. W. Mason Williams, Manufacturing Manager of the Jet Division, Thompson Products Inc., Cleveland, Ohio, is based on ten years of experience with Man-Au-Trol.

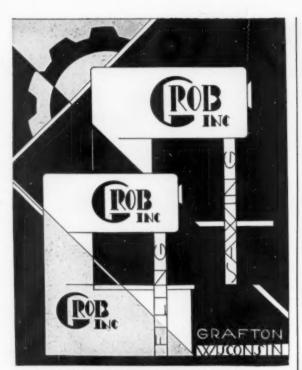
"If it hadn't been for Man-Au-Trol" Mr. Williams continues, "we would still be turning out aircraft engine components on manually-operated machines. Man-Au-Trol, particularly when tooled with better cutting tools, has enabled us to turn out at least five times as many compressor disc and turbine discs per shift as we produced on hand-operated equipment."

You, too, can apply to your machining problems the many advantages offered by Man-Au-Trol, Model 75 — just call your nearest Bullard Sales Office,
Distributor or write for catalog to



THE BULLARD COMPANY

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USE READER SERVICE CARD; INDICATE A-11-316-1

MAKE Rapid SET-UPS!



The set-ups you make for tapping and reaming jobs will require much less time if, instead of using an ordinary tool holder, you use a Ziegler Floating Tool Holder.

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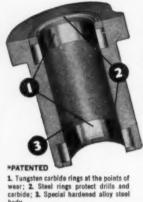




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INCREASE PRODUCTION... SAVE TIME & MONEY



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How? Like this: (1) Last longer ... with a life—in most cases—as long as solid carbide bushings at prices that approach the price of steel bushings; (2) Increased life for your drill jigs and fixtures; (3) Increased life for your drills and reamers; (4) Accuracy maintained for a LONG PERIOD of time; (5) Less non-productive machine time, less lost man-hours, because bushings need not be changed as often; (6) Inspection time saved, because of greater accuracy for a longer time; and (7) Less waste due to spoilage, for the same reason. Don't pass up a good bet! Get the dope on Mervo Carbide Inserted Drill Jig Bushings today!

For information and prices write for MEYCO Bushing Catalog No. 42.

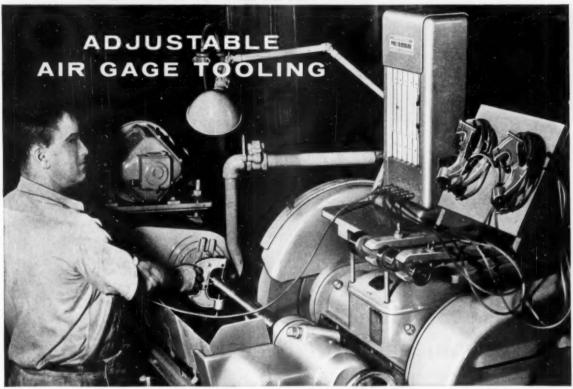
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SAVE with SHEFFIELD







ADJUSTABLE AIRBORE GAGE KITS

Here is a Short Run Job . . . 50 Shafts Like This to be Ground to a Tolerance of .0006"

The Adjustable Airsnap and Precisionaire shown, provide the absolute dependability of high—amplification air gaging which tells the operator exactly what he is doing all the time—prevents scrap.

At the same time, there is no cost penalty for single-purpose air gage tooling. This Airsnap is adjustable. It can be used just as effectively on the next job providing the new gaged diameter falls within the adjustment range—in this case, one inch.

Adjustable air gage tooling is available for the inspection of internal dimensions from $\frac{9}{2}$ " to 12"—for external dimensions up to 36". Write The Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 19.



Check with Sheffield on the many savings of Adjustable Air Gage Tooling.



"If you had asked me that question three months ago..."

"—I would have been a shamed to answer you. But to-day, Γm glad to say, we have a good Payroll Savings Plan-with~84.4% of our employees enrolled.

"Of course, we've always had The Plan – put it in during the war – but with changes in personnel and our failure to present the Plan to new employees, participation dropped to almost nothing.

"One day our State Director of the Savings Bond Division, U.S. Treasury Department, dropped in to see me. When he told me how far below average we were I asked him what we could do to bring it up. He gave me a complete campaign built around a person-to-person canvass that would put a Payroll Savings Application Blank in the hands of every employee, with the Treasury furnishing pay-envelope stuffers, posters and other

literature. I was a little dubious about the personal canvass but our employees were enthusiastic, in fact, officials of our union volunteered to undertake the canvass. There was no pressure, no teams, no prizes—just the distribution of the Application Blanks. Our employees did the rest—84.5% enrollment.

"84.5% is a good enrollment but we are not going to rest on it. A number of companies are in the 90% bracket—that's our goal."

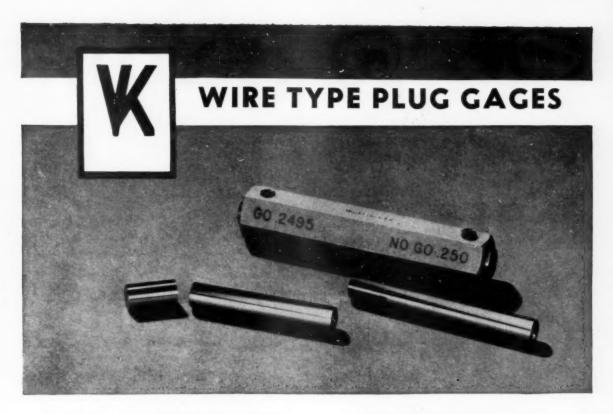
Your State Director, Savings Bond Division, U.S. Treasury Department, will be glad to help you install The Payroll Savings Plan, or build participation in an existing plan. Write: Savings Bond Division, U.S. Treasury Department, Washington 25, D.C.

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American Society of Tool Engineers
10700 Puritan Avenue Detroit 38

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VASTLY LONGER-LIVED and MONEY SAVERS... because they're "Cut-Off-Able" as well as "Reversible"

As a Van Keuren agent put it, "They're not only reversible, they're cut-off-able." And that means when you buy Van Keuren Wire Type Plug Gages, the sizes below %" may be cut off when ends become worn and as many as from five to ten gages made available from the 1%" and 2" long units. It is not only economical and practical to use Van Keuren Gages but it is a very simple operation to cut off the ends by following instructions furnished on request. The illustration above shows clearly the cut-off and reversible features.

VK Wire Type Gages are available in ZZ to XXX accuracies in sizes from .001" to 1.000". They are furnished in alloy tool steel, high speed steel, chromium plate or tungsten carbide. Whatever the gaging job, the extra length provided in VK units will save you money. It will also pay you to take advantage of VK deliveries. In many cases we can ship your requirements from stock.

VK Wire Type Plug Gages are fully described in Catalog & Hand Book No. 36, available on request.

Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:



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174 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . Light Wave Equipment . . Light Wave Micrometers . . . Gage Blacks . . . Wire Type, Taperlesk and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Geor Measuring Wires . . . Carbide Plug Gages , . Laps and Surface Plates . . . Precision Lapping Service.



37th YEAR

GADGETS CONTEST!



It you've thought up an interesting device that makes toolroom or production jobs easier, safer or more efficient, there's still time for you to enter the Gadgets Contest.

Early entries in the contest have contained many ideas which are of real practical value to tool engineers. They are ideas you won't find in any handbook, but they are valuable contributions to America's productive know-how.

Take a look at the Gadgets contained in the Gadgets Department of any issue of THE TOOL ENGINEER. They are typical of the sort of idea we are talking about.

Then sharpen up your pencil and get to work. Write a brief description of your Gadget, enclose a simple sketch and send your entry along. You many win one of the seven cash prizes and you'll have the satisfaction of knowing that your idea may be of real value to fellow tool engineers.

Gadgets Contest Rules

- ELIGIBILITY: This contest is open to all members of the American Society of Tool Engineers.
- DEFINITION: "Gadgets" are defined as tools or methods developed to solve specific production problems. They should contain a useful and practical idea or indicate an ingenious solution to a tool engineering problem.
- 3. PRIZES: One \$100 first prize, two \$50 second prizes, four \$25 third prizes, and honorable mention awards consisting of copies of the Tool Engineers Handbook or Die Design Handbook published by the American Society of Tool Engineers. Certificates will be awarded to all prize winners.
- PERIOD: The contest will run until December 31, 1956. All contributions to the Gadgets Department received from ASTE members during the period of the contest will be considered as entries.
- JUDGING: Entries will be judged on the basis of originality, conciseness and completeness of presentation, and usefulness to other tool engineers.

- Members of the ASTE National Editorial Committee will serve as judges. Winners will be notified by mail as soon as possible after completion of judging. A list of winning entries will be published in THE TOOL ENGINEER.
- 6. ENTRIES: The name and chapter affiliation of the author should be written on each page of the entry. No entries will be returned. All publication rights are assigned to THE TOOL ENGINEER. Authors of entries published in THE TOOL ENGI-NEER will receive honorariums. Information which has been published previously is not eligible.
- LENGTH: Entries should be limited to 500 words or less. Sketches or photographs should be used to illustrate the methods or devices described in the text of the entry.
- MAIL ENTRIES TO: Gadgets Contest Editor, The TOOL ENGINEER, 10700 Puritan Ave., Detroit 38, Mich.

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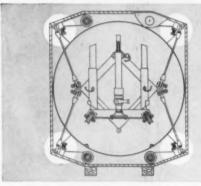
- · they cut clean
 - · live long
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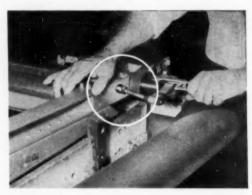


TOOLING IDEAS your shop can use!



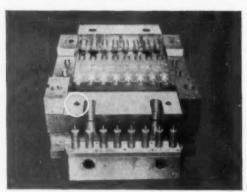
SPECIAL SWIVEL-PAD CLAMPS for a missile container manufacturer incorporate the remarkable Vlier ball-joint construction. Eight Swivel-Pad Clamps are used to release tension on cables which suspend the missile in its shipping container. This particular model withstands 21,000 load pounds.

Shown below are just a few of the many uses for Vlier tooling accessories. Although these standard accessories are primarily used in jigs and fixtures, many companies are using them to replace custom-made devices in original equipment.



CLAMPING PARTS WITH OFF-ANGLE SUR-FACES is no problem when Vlier Toggle Pads are used with a toggle clamp as shown here. The pad swivels 10° each side of the center line, assuring solid clamping of the part with no damage to the surface.





THIS 16-CAVITY, SIDE-ACTION PLASTIC MOLD uses four Vlier S-66 Spring Plungers as *detents* to lock the side-action bar in its travel to the center of the mold, eliminating costly, custom-made detents formerly used.



A glance at the new 1956 Vlier catalog will probably suggest many applications in your shop where you can standardize on Vlier accessories. Write for your free copy today.

New Head Design

on all Vlier Torque Thumb Screws protects working parts from dirt, chips, and other foreign matter. Truare ring makes disassembly easy. In all Vlier Torque Thumb Screws the ball-check is perpendicular to the screw axis, preventing uneven wear and wobble.



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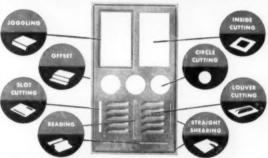
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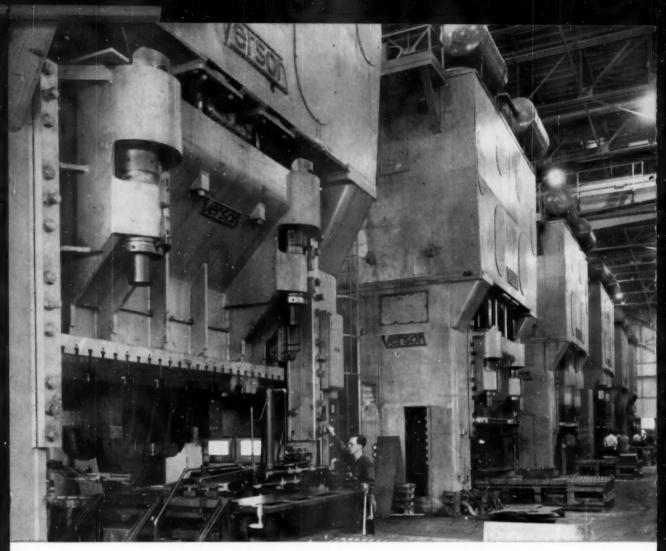
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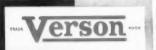
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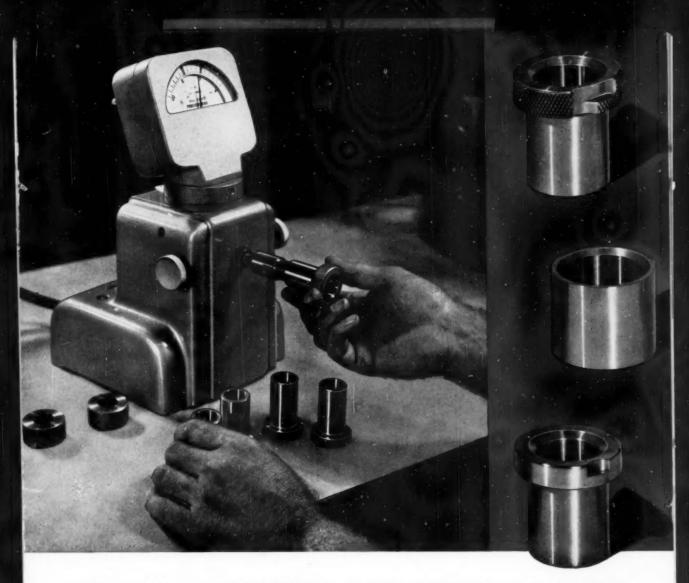


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